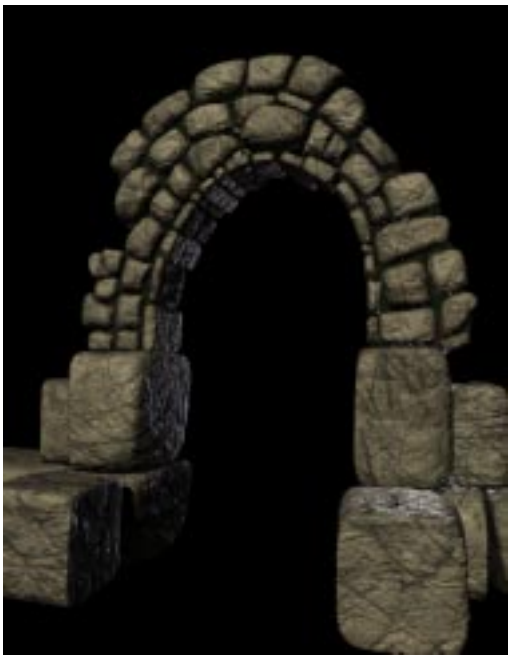
Rendering Basics



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1 Introduction to Rendering

Rendering an image or a scene is the final stage of creation in Maya, and can be an iterative, experimental process. Rendering is not a linear activity. Similarly, this book is not designed to be read from front to back; rather you can jump from chapter to chapter and section to section easily. Use the online version for moving quickly from topic to topic.

The procedure below will help get you acquainted with the basic activity of rendering a single frame. This chapter also contains a table of rendering activities that outline a typical rendering workflow, and provides cross references to relevant information.

This chapter contains the following sections:

- "Rendering a frame" on page 9
- "Rendering activities table" on page 16

Rendering a frame

Rendering a frame in Maya is an immediate gratification activity. It starts by creating or importing objects, texturing them, and lighting them. When you are ready to bring the scene into the photo-realistic world, you're ready to render.

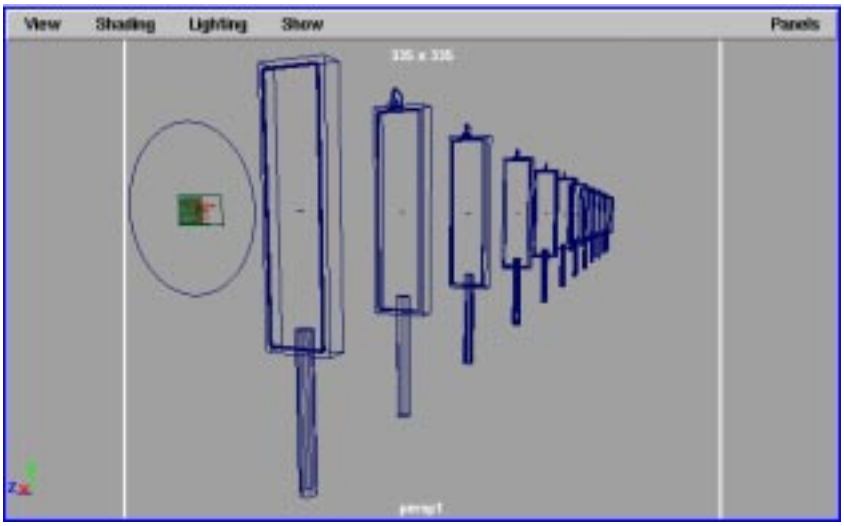
This section walks you through the basics of opening a scene and rendering it. If you do not have a scene to open, create a few objects and lights and save them. Then follow along in this procedure with your own file. By the end of it, you will be acquainted with some of the important windows and editors that you use during rendering activities.

To render a frame:

1 Select **File** → **Open Scene**.

2 Choose the scene you want to open and click **Open**.

The scene opens, and you can see objects, lights, and all the scene components. Objects will not always be wireframes when you open a scene; Maya saves the state of your scene when you exit, so when you start Maya again, everything is the way you left it.



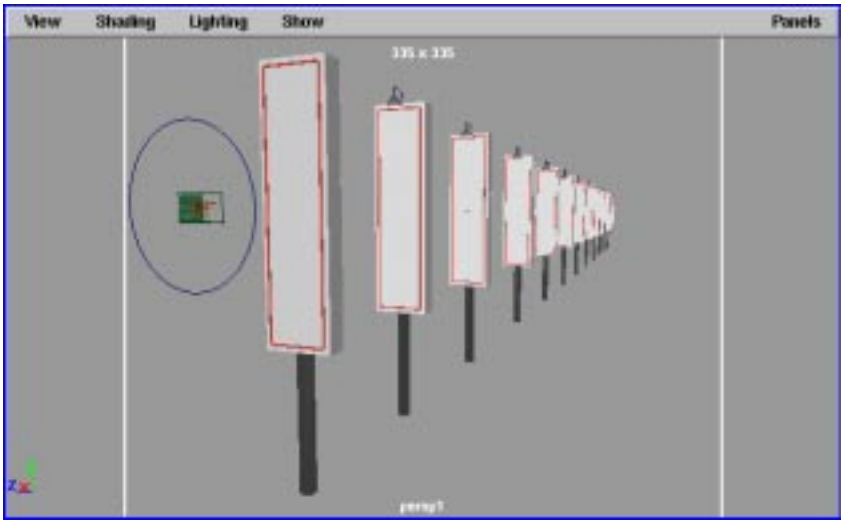
A newly opened scene, with all the objects displayed as wireframes

3 In the view's Shading menu, select **Smooth Shade All**.

The objects are shaded in the view to give you a better idea of their shapes and spacial relationships.

Tip

You can also use **Shading** → **Hardware Texturing**, which displays shades objects in the views with the shading group that are assigned to them. Using Hardware Texturing is resource intensive, and may impact Maya's performance.



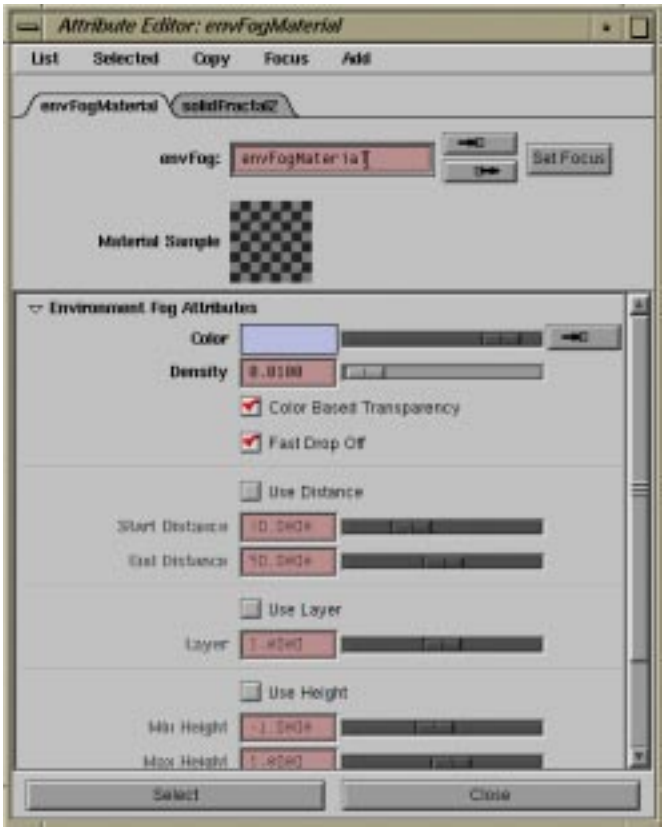
Shading the objects gives you a better idea of their size, shape, and spacial relationships to one another

4 Select **Windows** → **Multilister**.

The Multilister is displayed.

In the Multilister you can see rendering node connections, like which shading groups are assigned to which objects, which lights are connected to which shading groups, and so on. You can also make and break connections in the Multilister.

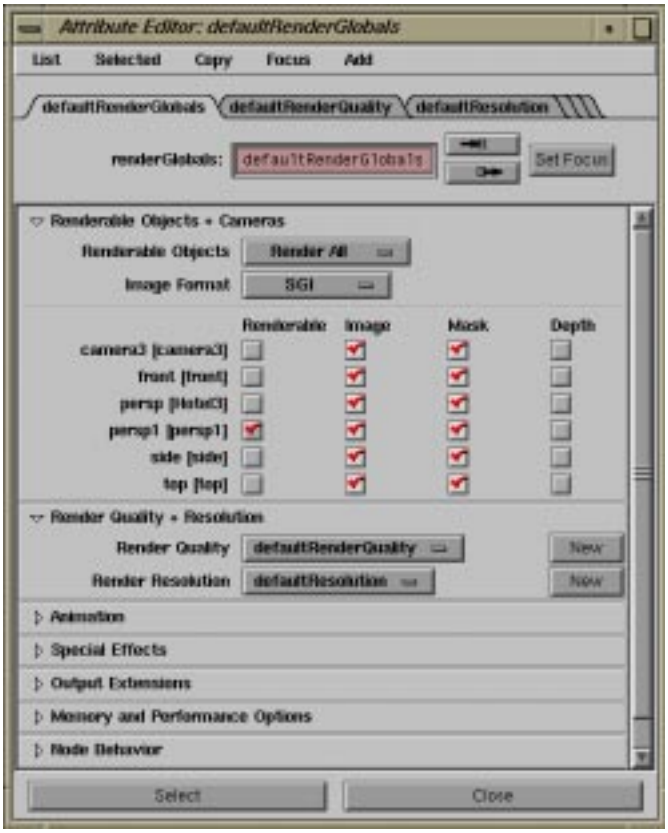
5 Double-click a shading group icon to open its attribute editor.



You adjust a node's attributes in its attribute editor. In this case, **Color-Based Transparency** is turned on, and Fast Drop Off is turned on.

6 Close the attribute editor.

7 Select **Render** → **Render Globals** to open the Render Globals window.



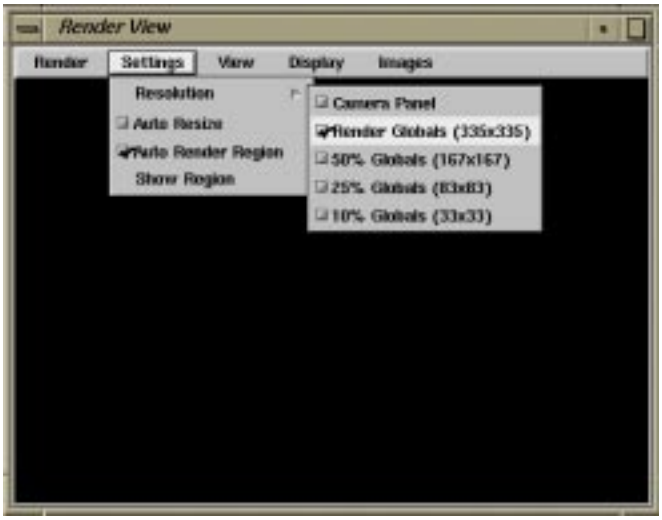
The Render Globals window contains many tuning settings for the renderer, among them are: Image Format, Output Extensions, Animation settings, and Special Effects like Film Gate and Environment Fog.

8 Close the Render Globals window.

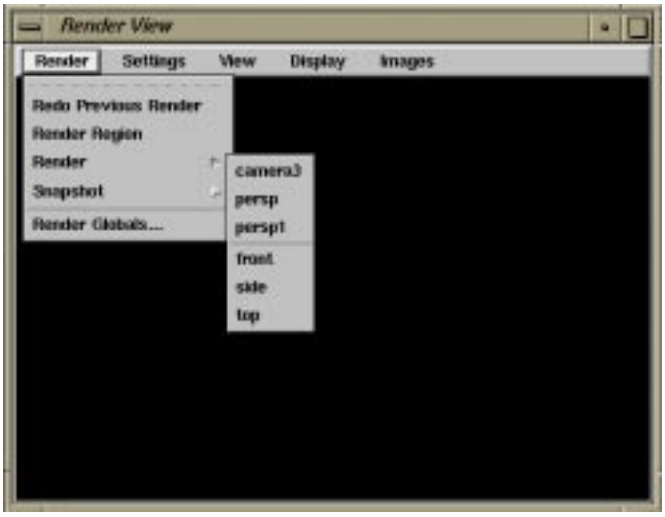
9 Select **Window** → **Rendering Editors** → **Render View**.

The Render View is displayed. The Render View is where your rendered frame is displayed. The menus in the Render view are for setting up how the Render View displays rendered images.

10 Select **Settings** → **Resolution**, and choose one of the resolution options. This is the resolution the image is rendered at.



11 Select **Render** → **Render** → **persp**.



Maya renders the frame. The image is displayed in the Render View. The rendering will take time to complete, depending on how complex or simple the elements in the scene are.

The rendered image remains displayed in the Render View until the next time you render an image. If you close the Render View, the image will still be there the next time you open it. The image is saved to disk so you can keep the image if you want. Save options and image file format options are found in Render Globals.

Rendering activities table

This section contains a table of links and cross-references that will help you find detailed information about rendering activities. Use the following table to familiarize yourself with the contents of the Maya renderer.

Rendering Activity	Relevant Topics
Opening a scene or files	Chapter 2, “Using the Multilister”

Rendering Activity	Relevant Topics
Using rendering editors	Chapter 2, “Using the Multilister” Chapter 6, “Using the Connection Editor” Chapter 7, “Using the Relationship Panel” Chapter 8, “Rendering Flags” Chapter 3, “Using the Render View Window”
Lighting the scene	Chapter 3, “Lighting a Scene” Chapter 6, “Creating Effects with Materials” Chapter 2, “Optimizing Maya’s Renderer”
Texturing	Chapter 6, “Creating Effects with Materials” Chapter 2, “Creating 2D Textures” Chapter 3, “Creating 3D Textures” Chapter 4, “Creating Environment Textures” Chapter 5, “Creating Materials” Chapter 7, “Creating Effects with 2D Textures” Chapter 8, “Creating Effects with 3D Textures” Chapter 9, “Creating Effects with Environment Textures” Chapter 11, “Using the Color Utilities”

Rendering Activity	Relevant Topics
Test Rendering	Chapter 2, “Optimizing Maya’s Renderer” Chapter 3, “Using the Render View Window”
Raytracing	Chapter 1, “Raytracing” Chapter 2, “Optimizing Maya’s Renderer”
Depth-map shadows	Chapter 4, “Using Depth Map Shadows”
Tuning the render settings	Chapter 2, “Optimizing Maya’s Renderer”
Rendering an animation	Chapter 4, “Rendering an Animation”
Batch rendering a final scene	Chapter 9, “Batch Rendering”
Cameras and image planes	Chapter 10, “Using Image Planes”

2 Using the Multilister

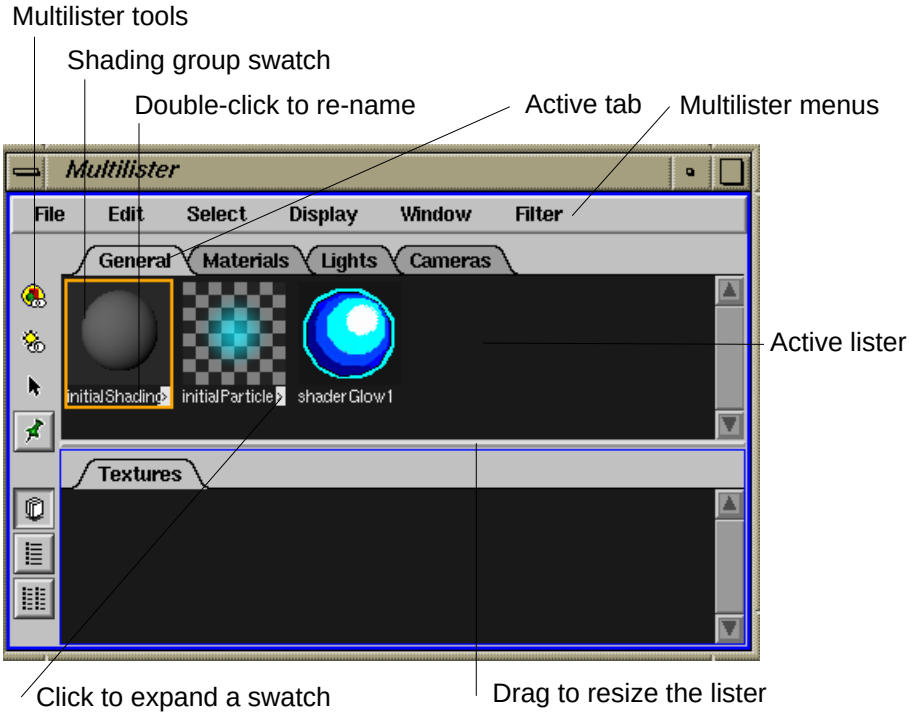
The Multilister is one of the central windows in Maya in which you perform operations on rendering nodes. Through the Multilister you can create, delete, assign, and connect rendering nodes. This chapter describes the concept of the Multilister, and provides procedures about how to use the Multilister.

This chapter contains the following sections:

- "Quick tour of the Multilister" on page 19
- "Using Drag-and-drop connections" on page 22
- "Assigning shading groups to objects" on page 23
- "Creating and texturing shading groups" on page 24
- "Opening related windows and editors" on page 26
- "Using the Shading Group tool" on page 27
- "Assigning shading groups to components" on page 28
- "Multilister menus" on page 29

Quick tour of the Multilister

When you open the Multilister you are in Highlight mode (**Select** → **Highlight Mode**). The **Select** tool on the left side is the default tool when you open the Multilister. This tool lets you select swatches in the Multilister and then perform actions on them, such as assigning shading groups to objects in the views, connecting materials to objects, opening attribute editors, and so on.



Highlight List and Selection List

When you select a swatch or swatches in the Multilister, a yellow border appears around the selction(s). (You can select multiple, nonadjacent swatches by using the Shift key and adjacent objects by dragging.) The Highlight List contains all the swatches highlighted in yellow. Some menu items depend on you selecting objects in this manner. Your Highlight List can include swatches from different tabs in the Multilister.

You can work in both the Multilister and the views at the same time. For example, one way to connect a shading group to an object in a view is to first select the object in the view (this adds the object to the Maya Selection List), and then highlight a swatch in the Multilister (which adds the swatch to the Multilister Highlight List). The Multilister Highlight List and the Maya Selection List are two distinct lists, each containing different data.

You can add items in the Multilister to the Selection List, but to do this you must turn off Highlight Mode (in the Multilister, **Select** → **Highlight Mode**). When Highlight Mode is turned off, swatches you select in the Multilister are added to the Maya Selection List, not to the Multilister Highlight List, and they are outlined in blue instead of yellow.

The active tab

The Multilister is actually several listers combined into one window. Think of listers in terms of the tabs you see in the Multilister when you first open it. The active tab appears on top of the others, outlined in a blue border (blue is the default color). As you move the cursor from lister to lister in the Multilister, and click in each region, you will notice the blue border outlines the lister that you click in. The active tab is the one that will be affected when you perform certain actions in the Multilister, for example, when you set Display options.

Render-node swatches

There are three swatches in the General tab by default when you open the Multilister. These swatches, which are visual representations of nodes that carry specific attributes, are applied to newly created objects in your scene. For example, when you create a sphere, the sphere is assigned to the initialShadingGroup, which is by default a gray Lambert shading group. Swatches update every time you make a change in the swatch's node network, so you can see the results of your changes immediately.

Swatches are more than visual representations. They also provide a convenient way into the attribute editors of the nodes. For example, if you create a Spot light, a Spot light swatch is created in the Multilister. When you want to adjust any of the Spot light's attribute, for example if you want to adjust the Cone Angle, double-click on the Spot light swatch to display the light's attribute editor.

You can expand and collapse swatches. Since the shading group is the highest level rendering node, that is, it is the visual culmination of all the nodes in a render node network, you may want to see a node that is connected to the shading group. By clicking on the expand button, you can quickly see which nodes are connected in a network. Double-click on any of the nodes in a network to display the attribute editor. Collapse the nodes to clean up the look of the Multilister.

Using Drag-and-drop connections

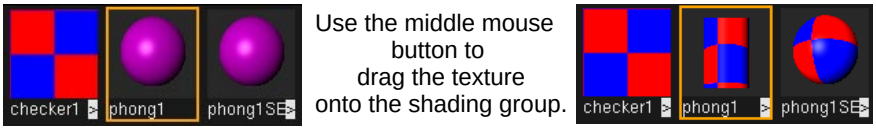
One of the most basic and powerful ways of connecting an attribute of one node to the attribute of another node is using the middle mouse button to drag-and-drop. Connections can occur between any two *compatible* attributes in Maya, that is, between two compatible input and output attributes. When you perform a drag-and-drop connection, Maya makes a default connection for you.

Drag-and-drop within the Multilister

To drag-and-drop a texture onto a Phong shading group:

Select a texture and use the middle mouse button to drag the texture onto a shading group to connect them.

The texture is mapped to the shading group, and the result is displayed in the Multilister.



Note

Drag-and-drop between two swatches in the Multilister creates only basic, default connections between the color channels of the nodes. If you attempt a drag-and-drop connection that does not involve the color channels of the nodes, the Connection Editor is displayed, which lets you make arbitrary connections.

Drag-and-drop: Multilister to attribute editor

You can drag-and-drop from the Multilister to a node's attribute editor, to make non-default connections. This is a very fast way to make arbitrary connections. When you drag a node from the Multilister to an attribute editor, black boxes are displayed around compatible attributes in the attribute editor. You can drop the node from the Multilister on any compatible attribute in the attribute editor.

To drag-and-drop: Multilister to attribute editor:

1. Double-click a shading group to open its attribute editor.
2. In the Multilister, use the middle mouse button to drag a texture onto a compatible attribute in the shading group's attribute editor. Releasing the mouse button completes the connection.

Assigning shading groups to objects

To assign a shading group to an object:

1. Select the object or objects in the modeling view. In the Multilister, select the shading group you want assigned, then choose **Edit** → **Assign**.

Tip

To reduce the time you spend assigning shaders to objects, you can change the default shader so that every time you create an object the default shader is assigned to it. Select the shader you want. Choose **Edit** → **Set Default Shading Group**. All objects created after that will be assigned this look. You can change the default look in this way at any time.

2. Click the **Shading Group** button, and then select a shader.

   Objects with the assigned look are selected in the modeling views.
3. To assign this look to other objects, select the objects in the modeling views.

Shading Group button

Tip

The Shading Group tool has two modes, shading-centric and geometry-centric. You can change the mode by double-clicking the **Shading Group** button, and selecting the mode you prefer in the Tool Properties window.

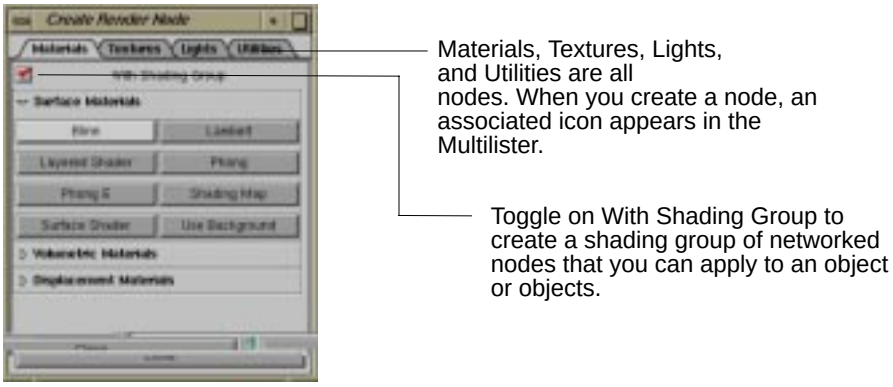
Creating and texturing shading groups

A node is the basic building block of a look that you can assign to an object or objects. A look is the visual culmination of one or many networked nodes. When many nodes are networked together and contribute dynamically to a look, they become a shading group.

To create a shading group, texture, or light:

1 Go to the Multilister, and choose **Edit** → **Create**.

The Create Render Node window is displayed, listing all the options.


Materials, Textures, Lights, and Utilities are all nodes. When you create a node, an associated icon appears in the Multilister.
Toggle on With Shading Group to create a shading group of networked nodes that you can apply to an object or objects.

2 Select the tab for the kind of node you want to create.

For example, if you want to create a blinn shading group, select the Materials tab. At least one new icon is created every time you create a new node. Use **With Shading Group** to create a shading group automatically when you create a node. For example, if you plan to assign a shading group to an object in your scene, toggle ON **With Shading Group** and Maya will create a shader node and a texture node and network them so you can assign the entire **shading group** to an object or objects.

3 Click Blinn to create a blinn shading group.

A blinn icon is displayed in the Multilister.

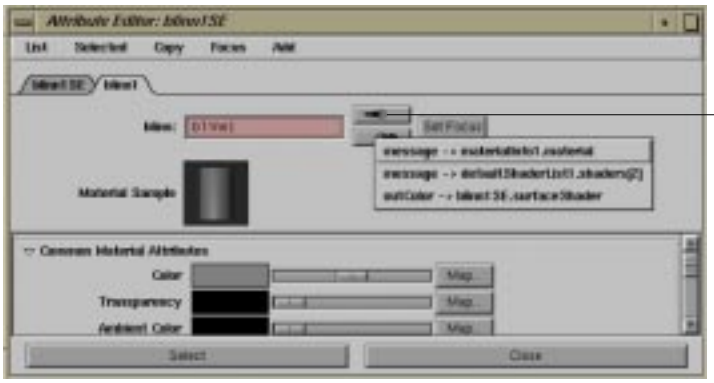
4 Close the **Create Render Node** window.

5 To see the parameters of the blinn shading group, double-click on its icon in the Multilister.

The blinn's attribute editor is displayed. When you change the blinn's attributes, the results are reflected in the icon in the Multilister.

Tip

Use **Node Inputs** and **Node Outputs** buttons to quickly move to a shader's input nodes or output nodes without leaving the attribute editor.



6 In the Multilister, choose **Edit** → **Create**.

The **Create Render Node** window is displayed.

7 Under the Textures tab in the **Create Render Node** window, choose between **2D**, **3D**, and **Environment** textures. Click the texture you want.

A texture shading group icon appears in the Multilister. If you expand the shading group icon with the arrow in the bottom right of the icon, you'll see a placement node, which defines how the texture is placed on the object. The texture swatch display will also reflect the placement parameters.

8 Close the **Create Render Node** window.

Opening related windows and editors

The Multilister brings together many functions in Maya. For example, if you want to see which connections created a shading group, you can highlight the shading group and then open any one of several windows that can provide you with information about the node. You can open the following windows from within the Multilister:

- Attribute Spread Sheet
- Connection Editor (see Chapter 6, “Using the Connection Editor”)
- Shading Groups Editor (see Chapter 5, “Using the Shading Group Editor”)
- Hypergraph

To view a connection in the Hypergraph:

Highlight a shading group in the Multilister.

Select **Window** → **Hypergraph Highlighted**.

The Hypergraph is displayed, showing the node you selected, plus its upstream and downstream connections.

Using the Shading Group tool

You use the Shading Group tool to see what objects are assigned to shading groups, and to assign shading groups to objects. This tool appears in the Multilister with the following icon:

- You can change the tool's properties (double-click on the tool to open its Tool Properties window) and use the tool in the Multilister.

To assign a shading group to an object:

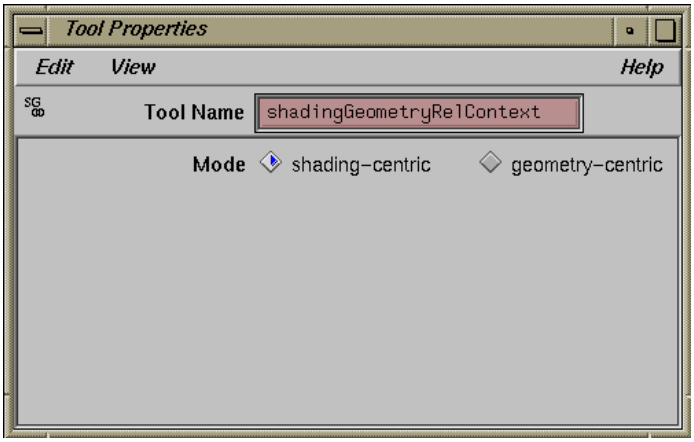
1. Select the tool in the Multilister.
2. Click a shading group swatch.

   Blue highlighting surrounds the selected swatch and the objects that are assigned to the shading group are highlighted in white in the modeling window.
3. To assign a shading group to a nonhighlighted object, select the object in the modeling window.

Tip

To unassign a shading group, select a highlighted object in the modeling window.

Shading Group tool options



Shading-centric mode

This is the default mode. When you click on a shading group in the Multilister, assigned objects are highlighted in white in the modeling window.

Geometry-centric mode

When you select an object in the modeling window, the shading group that is assigned to the object is highlighted in the Multilister.

Assigning shading groups to components

You can use the **Select by component type** tool to select portions of an object and make them components of the object. For example, you can select an area of a polymesh sphere. You can then assign a shading group to the selected area or component. Once you select an area, it behaves as if it were a component.

To select and assign components of objects:

1. Make a polymesh sphere.
2. In the Multilister, make two shading groups, a Phong and a Blinn. In their attribute editors, pick different colors for each shading group.

3 Add two directional lights to the scene, so the polymesh sphere is lit from two different directions.

4 Click the **Select by component type** tool then click the **Facets** tool. Click-drag to select the entire polymesh sphere. Then click-drag the area you want to turn into a component.

Note

You can select only complete polygons (or facets) in a polyset.

5 In the Multilister, select one of the shading groups you created earlier. Choose **Edit** → **Assign**.

You assigned the selected shading group to the selected component of the polymesh sphere.

6 Click the ShadingGeometryRelationshipTool in the Multilister, and select the default shading group.

The other component of the polymesh sphere is selected in the modeling window.

7 Choose the **Select** tool from the Tool Palette, and click once in the perspective window.

8 In the Multilister, select the second shading group you made earlier, and choose, Edit → Assign.

9 In the render panel, press the right mouse button and select **Render** → **persp**.

You can assign a different shading group to either component by using the Shading Group tool to select and deselect shading groups.

Multilister menus

Some menu items require you to first add a swatch or swatches to the Multilister **Highlight List**. See “Highlight List and Selection List.”

File menu

The File menu contains options that read and write information to disk, including Multilister preferences.

Import

Reads elements from another file and loads them into the current file.

Items in this menu open a file browser to a specific directory within the current project. You can point the file browser to any directory.

Texture/Material/ Shading Group... Opens a file browser to the current project's *textures* directory.

Light Opens a file browser to the current project's *lights* directory.

Render Scenes... Opens a file browser to the current project's *render* directory.

Export Highlighted

Exports the contents of the active lister's **Highlight List** into a new file. The file browser opens to its best guess directory, but can browse to any directory, or cancel, before exporting.

Export as

The same as **Export Highlighted**, except you can choose the project directory where you want to save the file.

Texture/Material/ Shading Group... File browser opens to the current project's *textures* directory.

Light... File browser opens to the current project's *lights* directory.

Render Scene... File browser opens to the current project's *render* directory.

Preferences

Multilister preferences include: the number and location of tabs, their labels, filters, sort information, new cell placement, pin state, whether work area and toolbar are showing, and window proportions of the visible listers.

Information not included in preferences settings: default shading group, **Highlight List**, work area proportion if it is not showing, work area contents (contents are only lost between Maya sessions).

Save Multilister Saves the Multilister's current preferences.

Revert To Default Returns the multilister to its default preferences. This is useful when you open a project that contains someone else's preferences.

Edit menu

Contains options that edit parts of the current scene, usually affecting specific nodes within the Multilister and objects in Maya's **Selection List**.

Assign

Assigns an object or objects in the modeling view to a highlighted shading group in the Multilister. You must have a shading group highlighted and geometry selected for this option to work.

Create...

Displays the Create Render Node window, from which you create materials, textures, lights, and rendering utilities.

Keyframe

Set a key on the highlighted object or objects. This options has one submenu for each highlighted node, which contains the node's keyable attributes. Choosing one sets the key.

Delete Highlighted

Deletes all nodes in the Multilister **Highlight List**.

Delete Unused

Deletes all nodes in the Multilister that are not assigned or connected to shading groups. This includes shading groups, materials, textures, utilities, and image planes.

Delete By Type

Deletes specific types of objects.

All in Tab Deletes every node in the active tab.

Textures Deletes every texture node.

Shading Groups and Materials Deletes all shading groups and materials.

Lights Deletes all lights.

Set Default Shading Group

Sets the highlighted shading group as the default shading group. All new geometry is shaded with the default shading group. Changing the default shading group does not change the color of existing geometry, only geometry created after the change. The default shading group is not a Multilister preference, and is not saved when you end the Maya session.

Map Displacement

Requires that a single shading group is highlighted. Displays the Create Render Node window and maps the node you create as a displacement shader on the shading group.

Map Surface

Requires that a single shading group is highlighted. Displays the Create Render Node window and makes a default connection between the shading group or its material and the node.

Map Volume

Requires that you highlight a single shading group. Displays the Create Render Node window and makes a default connection between the shading group or the volume shader itself and the node.

Particle Age Map

Contains options for shading software-rendered particles. Useful for using a ramp texture to define the color of a particle over the course of its life. Requires either a single particle cloud material, or a single particle cloud and an existing texture.

Color Lets you create a texture or use an existing texture to define the color of a particle as a function of the particle's age.

Incandescence Lets you create a texture or use an existing texture to define the incandescence of a particle as a function of the particle's age.

Transparency Lets you create a texture or use an existing texture to define the transparency of a particle as a function of the particle's age.

Convert Solid Texture

Requires a 3D texture on the **Highlight List** and surfaces on the **Selection List**. Takes a 3D texture and creates file textures, one for each mappable surface on the object. Useful to prevent an animated object from *swimming* through a 3D texture.

Link To Object

Requires that you highlight a 3D TexturePlacement and select geometry in the view. Creates a connection between the placement and the geometry so that translating the object will not result in the object *swimming* through the texture.

Note

If you deform the object, this option will not prevent the *swimming*.

Select menu

The Select menu contains options that manipulate the **Selection List** or the Multilister **Highlight List**.

Select Assigned

Requires you to highlight one or more shading groups. Selects the geometry that is assigned to the highlighted shading group.

Highlight Selected

Highlights any nodes in the active tab that are connected to the selected geometry in the view.

Select Default Shaded

Selects all geometry currently shaded by the default shading group. Also highlights the default shading group.

Highlight Mode

When turned on, nodes selected in the Multilister are added to the **Highlight List**. When turned off, nodes selected in the Multilister are added to Maya's **Selection List**.

Note

You can use the Shift and Ctrl keys to select multiple, nonadjacent nodes in the Multilister tabs.

Display menu

Expand/Collapse

Contains options for changing the expand / collapse state of the highlighted nodes.

Expand Expands all highlighted nodes.

Expand Al Expands all nodes.

Collapse Collapses all highlighted nodes.

Collapse All Collapses all nodes.

Swatch Primitive

Changes the swatch primitive of materials only. Shading groups are always spheres, and textures are always flat planes.

Ball Changes all material swatch primitives to a ball shape.

Box Changes all material swatch primitives to a box shape.

Cone Changes all material swatch primitives to a cone shape.

Tube Changes all material swatch primitives to a tube shape.

Swatch Quality

Affects the sampling rate and the render time of all swatches. The default is Low.

Tabs

Contains options concerning the creation, deletion, and location of tabs in the Multilister. To rename a tab, double-click the tab label, type a new name, then press Enter.

Create Creates a new tab and puts it in the top tab group.

Create Filtered Creates a new tab and puts it in the top tab group. Allows the filter to be specified before creating the tab.

Move Tab Up Deletes the active tab from the bottom group and adds it to the top.

Move Tab Down Deletes the active tab from the top group and adds it to the bottom.

Remove Deletes the active tab on the top group.

New Items First

Places newly created nodes in the top-left corner of the Multilister. By default, new items go in the bottom-right corner of the Multilister.

Always Sort

When new nodes are created, they appear in their sorted positions.

Sort

If **Always Sort** is turned off, Sort will sort all nodes in the active tab using the **Sort By** option.

Sort By

Name Sorts nodes alphabetically, by name.

Type Sorts nodes alphabetically, by node type.

Reverse Order Sorts nodes in reverse alphabetical order, from Z to A.

Show Toolbar

Shows / hides the column of buttons on the left side of the Multilister.

Show Work Area

Shows / hides the work area, which is a clipboard-like area at the bottom of the Multilister. The work area is a lister, and you can use the middle mouse button to drag nodes to and from it as in any other lister in the Multilister.

As Icons

Displays nodes as icons or swatches, arranged from top left to lower right, in the Multilister. This is the default display.

As List

Displays nodes as columns of text in the Multilister.

As Columns

Displays nodes as icons or swatches, arranged in columns, in the Multilister.

Window menu

All the options in this menu display other windows that relate to nodes in the highlighted in the Multilister.

Attribute Editor...

Displays the attribute editor for the first node on the **Highlight List**.

Attribute Spread Sheet...

Displays the Attribute Spread Sheet containing all nodes on the **Highlight List**.

Connection Editor...

Displays the Connection Editor. You can load the Connection Editor by using the middle mouse button to drag swatches from the Multilister to the panels of the Connection Editor.

Connect Highlighted...

Displays the Connection Editor with the first highlighted node on the left and the second highlighted node on the right. If more than two nodes are highlighted, only the first two are loaded. If less than two nodes are highlighted, the Connection Editor does not open.

Shading Groups Editor...

Displays the Shading Groups Editor.

Hypergraph Highlighted...

Displays the Hypergraph, and shows up- and downstream connections of the highlighted node.

Filter menu

The Filter menu contains options that affect the contents of the active tab.

Reload

Removes the current contents and reloads the tab with all nodes that the tab's filter allows.

Show Selected

Removes all nodes that are connected to the currently selected geometry in the view.

Show Highlighted

Removes all nodes that are not highlighted.

Hide Highlighted

Removes all nodes that are highlighted.

Hide All

Removes all nodes from the tab.

Always Filter

When turned on, displays only new nodes that pass the current filter. When turned off, any new rendering node created is displayed. The default is on.

Apply Filter

Applies only if **Always Filter** is turned off. Applies the tab's filter to the contents of the tab.

Basic filter

Displays only shading groups, lights, textures, and utilities.

Materials filter

Displays all nodes attached to the material classifier node. By default, this filter applies to all nodes in the Materials tab in the Create Render Node window.

Texture filter

Displays all nodes attached to the texture classifier node. By default, this filter applies to all nodes in the Textures tab in the Create Render Node window.

Using Image Files filter

Displays all nodes that have that currently use an image file somewhere in their history.

Shading Groups

Show All Displays all shading groups, materials, and textures connected to shading groups.

Show All with Textures Displays shading groups and their textures.

Show All with Lights Displays shading groups and light nodes.

Lights

Show Lights Displays all lights that are in the scene.

Show Linked Displays only linked lights.

Show Exclusive Displays only exclusive lights.

Show Non Exclusive Displays only lights that are part of the **defaultLightList**.

Show Non Illuminating Displays only lights that are being ignored.

Cameras

Displays cameras and image planes.

Image Planes

Displays only image planes.

Utilities

Displays all nodes attached to the utility classifier node. By default, this filter applies to all nodes in the Utilities tab in the Create Render Node window.

All Types

Displays shading groups, lights, materials, textures, and render utility nodes.

Other

This is a list of other pre-made filters, which have descriptive labels.

Highlight into Work Area

Loads all nodes in the **Highlight List** into the work area. The Work Area is a convenient place to organize nodes you work with often or nodes that are conceptually connected.

Tool bar

Pin button

When pressed, new nodes added to the Multilister do not appear in the *pinned* tab. When you unpin the tab, all the nodes are displayed.

Folder View

Same as **Display** → **As Icons**.

List View

Same as **Display** → **As List**.

Columns View

Same as **Display** → **As Columns**.

Update Button

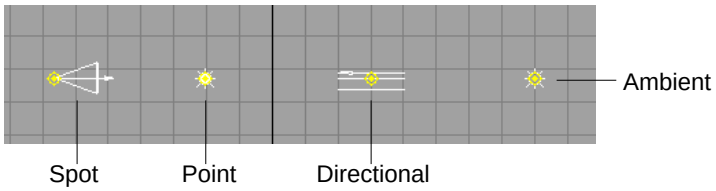
When pressed, prevents all swatches in the Multilister from updating when upstream changes are made. This is particularly useful when you are making many changes to the nodes and you do not want to wait for the Multilister to update after every change. When turned off, the Multilister swatches update normally, whenever you make an upstream change to a node.

Work Area Button

Same as **Display** → **Show Work Area**.

3 Lighting a Scene

The Lighting menu contains light-related commands. You can choose from four kinds of lights: Ambient, Directional, Point, and Spot. To create a light, select **Lighting** → **Ambient**. After you create a light, you can edit its attributes, its orientation, and you can create effects with them.



To edit a light's attributes, double-click on the light's swatch in the Multilister. The light's attribute editor is displayed. You can watch the changes interactively in the attribute editor's **Intensity Sample**.

This chapter contains the following sections:

- "How lights work in Maya" on page 42
- "Creating lights" on page 43
- "Linking lights" on page 51
- "Light types" on page 54
- "Common light attributes" on page 59

Note

When you render, you must have at least one light in the scene so the renderer can pick up the objects. If you render a scene with no lights, the rendering will be completely black.

Tip

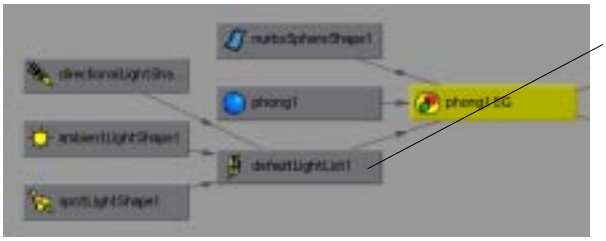
Use only as many lights as necessary to achieve the look you want. Rendering many lights will increase rendering time. Make sure lights are linked and exclusive, and that the scene is as efficient as possible. See Chapter 2, “Optimizing Maya’s Renderer.”

How lights work in Maya

To render an object, you must assign the object to a shading group that is linked to at least one light. In Maya, lights are linked to shading groups, not to objects. You can designate a light in three ways.

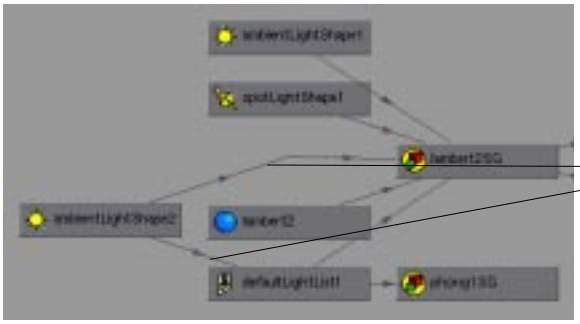
As part of the defaultLightList

By default, every time you create a light, Maya puts it in the **defaultLightList**, which links the light to all the shading groups in the scene. When you create a new shading group, all the lights in the defaultLightList are assigned to it.



Ignored

If you create a shading group that you don’t want all the lights in the defaultLightList to shine on, you can tell the shading group to ignore specific lights. You do this using the Light Linking tool (see “Linking lights” on page 51). You can link a light to as many or as few shading groups as you want.



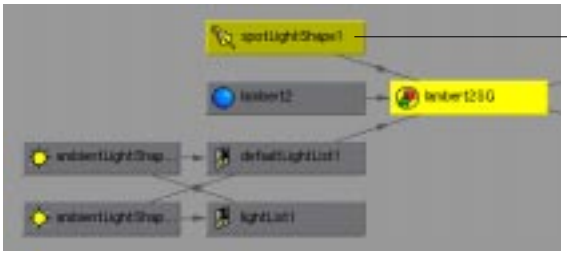
Ambient light is ignored by the Lambert shading group, and it is linked to the Phong shading group via the defaultLightList.

exclusive

If you create a light, and want it to shine only on a particular shading group or shading groups, you can make the light **exclusive** (see “Linking lights” on page 51). When you make a light exclusive, the light is removed from the defaultLightList, and when you create new shading groups, the light will not light them; it only lights the shading group or groups you link it to.

Note

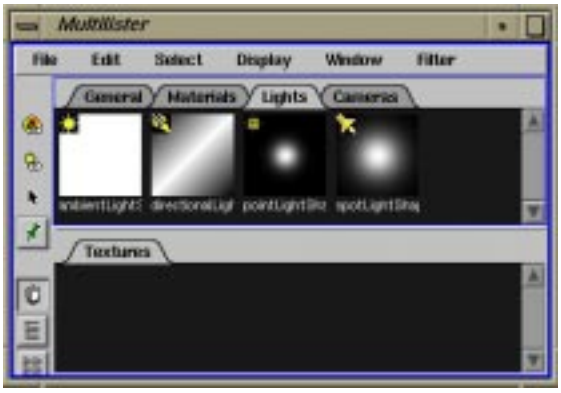
When you make a light exclusive, it is removed from the defaultlightlist. It will not shine on anything until you link it to a shading group or groups.



This light is exclusive (it is no longer part of the defaultLightList), and it is linked to the Lambert shading group

Creating lights

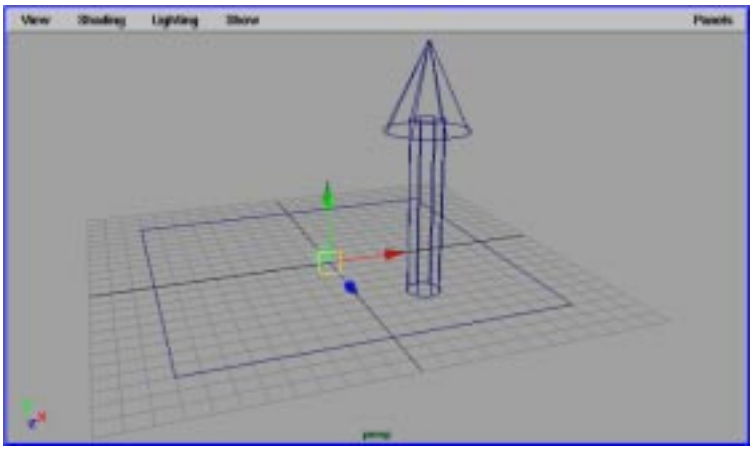
When you place a light in the modeling window, a light swatch appears in the Multilister. Each light type has a unique swatch.



To light an object:

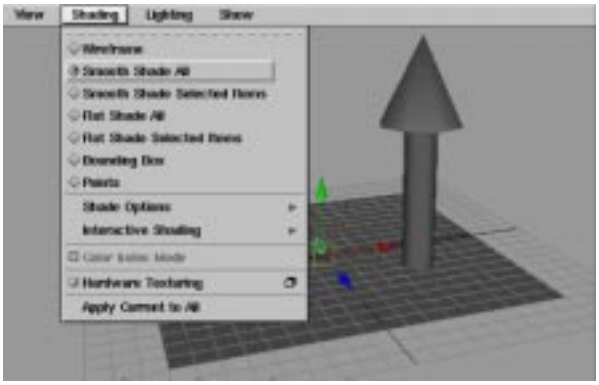
1. Create an object or open a scene (**File** → **Open Scene**).
2. Choose **Lighting** → **Create Spot Light** (or **Directional**, **Point**, or **Ambient**).

   The light is displayed at the origin of the views.



3. Position the light using the **Move** tool.

4 Choose **Shading** → **Smooth Shade All** to shade the objects in the active view.



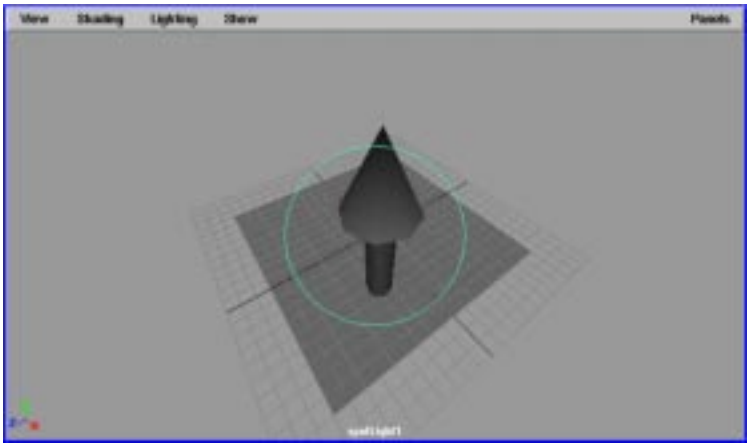
5 Choose **Lighting** → **Use All Lights** to see the effect the lights in your scene have on the objects.

As you move objects or lights in the view, the lighting changes, giving you a rough idea of how the rendered image will look.

Note

Surfaces with very few spans (for example, when there is one span each in the U and V directions) at low resolution, may not appear to be affected by selecting **Use All Lights**. To correct this, increase the number of spans on the surface.

6 Select the light in the **persp** view, and choose **Panels** → **Look Through Selected**.



The view changes so you are looking through the light you selected in the view. You can change the position of the light using the **Track**, **Dolly**, and **Tumble** tools. This is a good technique for positioning lights accurately. Select **Panels** → **Perspective** → **persp** to return to the persp view.

To adjust the color of a light:

You can change the color of any light, or map file to the color channel of any light.

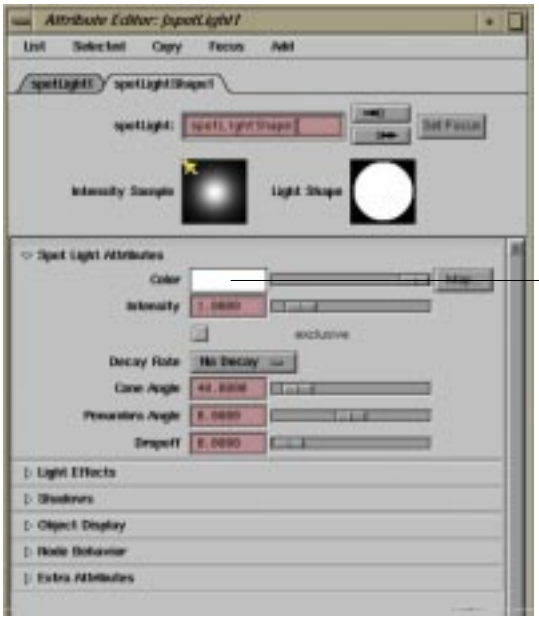
1 Select the light in a modeling view.

2 Open the Multilister by choosing **Window** → **Multilister...**.

The Multilister is displayed.

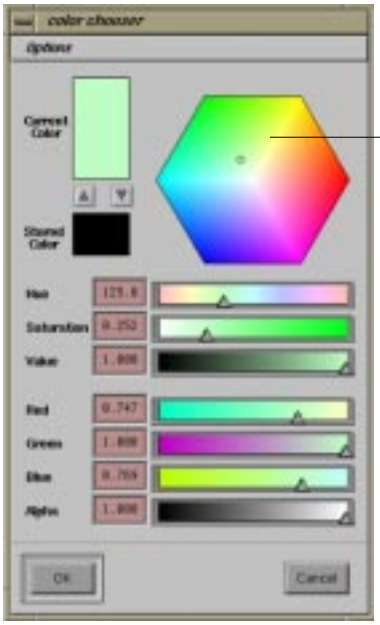
3 Double-click the icon of the light you want to edit.

The light's attribute editor is displayed.



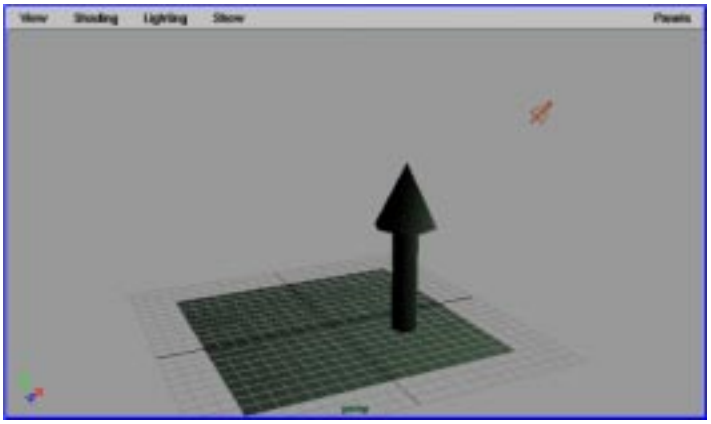
4 Click the **Color** swatch in the Light Attributes section of the light's attribute editor.

The **Color Chooser** window is displayed.



5 Choose a color by dragging in the color wheel, or by adjusting the **Hue**, **Saturation**, and **Value** sliders or the **Red**, **Green**, **Blue**, and **Alpha** sliders.

6 Click **OK**.



The color of the light changes, and you can see the new color in the **Intensity Sample** at the top of the light's attribute editor. The light's new color is also evident on the shaded objects in your modeling views because you turned on **Lighting** → **Use All Lights**.

To make a light cast shadows:

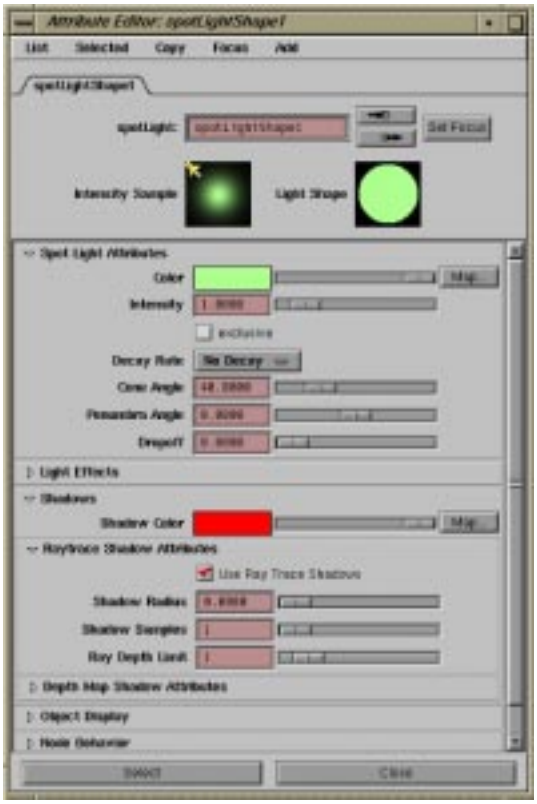
You have to tell Maya to cast shadows in your scene. Since casting shadows takes more time to render, the default for casting shadows is **off**. However, if you plan to use shadows, you can create them using one of two ways:

- To create shadows without raytracing, turn on **Use Depth Map Shadows** in the **Depth Map Shadow Attributes** section of the attribute editor. The advantage of using depth-map shadows is that you can reduce rendering time. See Chapter 4, "Using Depth Map Shadows."
- To create shadows with raytracing, you need to turn on **Use Ray Trace Shadows** in the **Ray Trace Shadow Attributes** section of the light's attribute editor and turn on **Enable Raytracing** in the **Raytracing** section of the **Render Globals** as described in the following section.

1 In the Multilister, double-click the light that you want to cast shadows.

The light's attribute editor is displayed.

2 In the **Raytrace Shadow Attributes** section of the **Shadows** section in the light's attribute editor, turn on **Use Raytrace Shadows**.



The Raytrace Shadow attributes are enabled, and you can adjust the number of samples, the radius (in spot light), and limits. The default shadow color is black, but you can change the color by clicking the **Shadow Color** swatch.

3 Close the attribute editor.

4 Choose **Render** → **Render Globals...**, and go to the **defaultRenderQuality** tab.

The **Render Quality** attributes are displayed.

5 Toggle on **Enable Raytracing** in the **Raytracing** section, and close the attribute editor.

Now, when you render, your light will cast shadows.

6 Select **Window** → **Rendering Editors** → **Render View...**, and render the view.

Linking lights

After you place lights in a scene, you'll want to link them to objects as a first step towards creating light effects.

When you create a light, by default it belongs to the **defaultLightList**, which means that it is linked to all shading groups in the scene.

You can make a light **exclusive**, so it shines only on a particular object or objects. Making a light exclusive removes it from the **defaultLightList**. To make a light exclusive, double-click on the light's swatch in the Multilister, and click **exclusive** in its attribute section.

Note

When you render, you must have at least one light in the scene so the renderer can pick up the objects. If you render a scene with no lights, the rendering will be completely black.

Using the Light Linking tool

To link lights using the Light Linking tool:

1. Create some objects and lights.
2. Assign shading groups to the objects.
3. Open the Multilister. Double-click the Light Linking tool (see “Light Linking tool options” on page 53) to open its **Tool Properties** window. Select **light-centric**. You can also use the geometry-centric mode, but the procedure below assumes you are using light-centric. Close the Tool Properties window.
4. In the Multilister, click the Light Linking tool.

   The shading group that was last selected in this mode, as well as its linked lights, are outlined in blue.
5. Click a shading group swatch to see which objects are assigned to it and which lights are linked to it.

   Objects that are assigned to it get selected in the views.

   In the Multilister, linked light swatches are outlined in blue.

To link a light to a shading group, select the shading group and click the light you want to link to it.

This shading group has two lights linked to it.

To unlink a light from a shading group, select the shading group, then click the light you want to unlink.

This shading group has only one light linked to it.

6 To link lights to the selected shading group, do one of the following:

- Click on lights in a modeling view that are not highlighted to link them to the selected shading group. The lights are selected.
- Click on light swatches in the Multilister to link them to the selected shading group. The linked light swatches become outlined in blue.

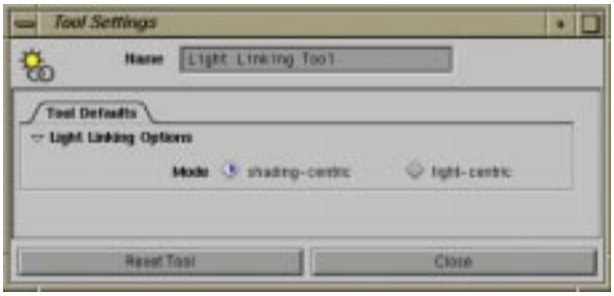
To unlink lights using the Light Linking tool:

To unlink lights from the selected shading group, do one of the following:

- Click on selected (linked) lights in the modeling window to break the link between the light and the selected shading group. The light is de-selected.
- Click on a light's swatch in the Multilister to break the link between the light and the selected shading group. The unlinked light swatch is no longer outlined in blue.

Light Linking tool options

You can change the tool's properties (double-click on the tool to open its Tool Properties window) and use the tool in the Multilister.



Shading-centric mode This is the default mode. In the Multilister, click on a shading group. In the modeling window you'll see which geometry and lights are linked to the selected shading group.

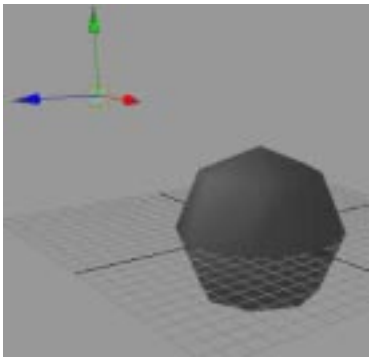
Light-centric mode In the modeling window, select a light. In the Multilister, you'll see which shading group or groups the selected light is connected to.

Light types

When you open a light's attribute editor, you can view and change all its attributes. Each light attribute editor has an **Intensity Sample** so you can view the effects of your changes interactively as you make them.

Ambient lights

Ambient lights are similar to **Point** lights except that only a portion of the illumination emanates from the point. The remainder of the illumination comes from all directions and lights everything uniformly.



Ambient Light attributes

Ambient Shade

Use **Ambient Shade** to define the omnidirectional component of the ambient light. By setting **Ambient Shade** to 0.0, ambient light comes from all directions, and surfaces will show no depth definition and appear flat shaded. If set to 1.0, the ambient light comes solely from the position of the light and objects show definite edge contrast. The **Ambient Shade** default is 0.45.

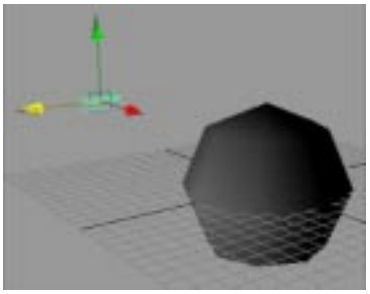
Directional lights

Directional lights have color, intensity, and direction, but no obvious source in the scene. For example, the sun can be considered a directional light since it is far enough away from Earth that light rays emanating from it are effectively parallel. Directional lights do not decay with distance.

Note

Because directional lights have a direction but no obvious source, using secondary rays by raytracing can give the effect of casting shadows on objects 'behind' the light's apparent location in a scene.

'

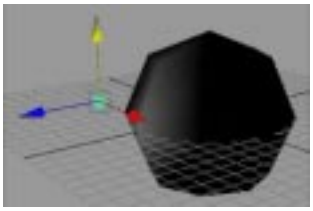


Point lights

Point lights are like incandescent light bulbs—they throw off light in all directions.

Note

When you are using depth-map shadows with a Point light, you can control the direction in which the light casts shadows. You do this by setting the appropriate **Dmap** settings in the **Depth Map Shadow Attributes** section of the light's attribute editor. For example, if you use a point light to shine on a table, and you only want the light to cast shadows on objects on the table surface, only turn on the Use **X- Dmap**.



Decay

Decay Rate

Controls how quickly the light fades with distance. It can be set to a value from 0 to 3. The default setting is 0.

Decay Setting	Effect
0	Light reaches everything since there is no decay.
1	Light intensity is decreased in direct (linear) proportion to the distance.
2	Light intensity is decreased inversely proportional to the square of the distance. This is how light decays in the real world.
3	Light intensity is decreased proportional to the cube of the distance. This results in light decaying faster than in the real world.

Light Effects

Light Fog Creates a lightFog node, and connects it to the point light. Fog geometry appears in the modeling window, connected to the light. The lightFog attribute editor is displayed, and you set the light fog attributes.

Fog Type You can set Normal, Linear, or Exponential fog types. See “Light Fog.”

Fog Radius Sets he radius of the fog. The default value is 1.0.

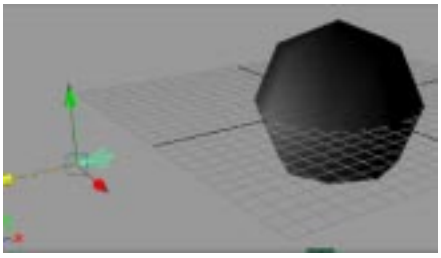
Fog Intensity Sets the intensity of the fog. The default is 1.0.

Light Glow Creates an opticalFX node in the Multilister and connects it to the point light. The opticalFX attribute editor is displayed, and you set the light glow attributes. See

Spot lights

Spot lights cast light in one direction only, emanating from a point in a cone.

Spot Light attributes



Cone Angle Value that represents the measure in degrees of the angle from edge to edge of the spotlight's beam. The valid slider range is 0.5 to 1 79.5. The default value is 40.

Penumbra Angle Provides an alternate way to control the dropoff of the spotlight's intensity towards the edge of the cone.

The value is defined in degrees relative to the spot light's spread. The intensity of the spotlight falls off linearly between the angle specified in Spread, and the Spread angle and Penumbra are added together.

For example, a Spread of 50 degrees and a Penumbra of 10 degrees would mean that the spotlight had an effective spread of 60 (50 + 10) degrees, but the intensity of the spotlight would dropoff to 0.0 between the angles of 50 and 60 degrees. A negative penumbra maintains the effective spread angle as specified. For example, a Spread of 50 degrees with a Penumbra of -10 means that the spot light has an effective spread of 50 degrees and the intensity of the spot light would dropoff to 0.0 between the angles of 40 and 50 degrees.

Dropoff Controls the rate at which light intensity decreases from the center to the edge of the spotlight beam. The valid range is from 0 to ∞. The range usually used is from 0 to 50. Values of 1.0 and less give practically identical results, that is no discernible intensity decrease along the radius of the beam. The default value is 0.0, which means there is no dropoff.

Tip

Penumbra, an independent effect, can appear to have superficially similar results, but is more intuitive to control.

Barn Doors

Doors or shutters fitted on the spot light, which let you create a square spot effect. The default value for all four barn doors is 20. The value represents the angle measured from the center of the spot light to the position of the barn door. The range of values is between -30 and 30.

Barn Doors toggle Activate barn doors when toggled on. The default is off.

Spotlight Preview Display

Displays the shape that the spotlight will cast as seen, for example, on a wall. The shape changes when you change the values of the light's cone angle, barn doors, and so on.

Decay Regions

Use Decay Regions toggle Toggles **Decay Regions** on and off. The default is **off**.

Region 1/2/3 Controls decay in three regions, Region1, Region2, and Region3.

Start Distance1 Defines how far out from the center of the volume the decay starts.

End Distance1 Defines how close to the center of the volume the decay gets.

Light Effects

Light Fog Creates a lightFog node, and connects it to the point light. Fog geometry appears in the modeling window, connected to the light. The lightFog attribute editor is displayed, and you set the light fog attributes.

Fog Type Sets Normal, Linear, or Exponential fog types. See "Light Fog."

Fog Radius Sets the radius of the fog. The default value is 1.0.

Fog Intensity Sets the intensity of the fog. The default is 1.0.

Light Glow Creates an opticalFX node in the Multilister and connects it to the point light. The opticalFX attribute editor is displayed, and you set the light glow attributes.

Intensity Curve Use in conjunction with decay, as a measurement tool, or as an animation curve, with distance versus intensity.

Color Curves Same as **Intensity Curve**, but with color instead of light intensity.

Common light attributes

All lights have several common attributes that appear in each light's attribute editor.

Intensity Sample section

The interactive Intensity Sample displays how light attribute settings affect the selected light. When you change a value in the attribute editor, you immediately see the result in the swatch display.

Common Attributes

Intensity Defines the brightness of the light. The default is 1.0. Setting a light to 0.0 means that no light is produced. Setting a light to a negative value means that the light is removed from a scene in the area of the light's influence.

Tip

Negative intensity can be used to reduce or remove hotspots or glare.

Color Represents the color of the light. The default is white.

Tip

Use the slider next to the **Color** box to adjust the gray value of the color in the **Color** box.

To change the color of the light, click the color swatch next to the light's Color attribute label. The Color Chooser window opens. Click on the color palette or enter Hue, Saturation, and Value values. Click **Apply** to see the result in the attribute editor's swatch. Click **OK** to close the Color Chooser.

You can map a texture on to the Color of a light. Click **Map...** to open the Create Render Node window. Add a texture node by clicking the appropriate texture button. You can add a 2D, 3D, or environment texture.

exclusive When toggled **on** (indicated by a check mark), objects that are linked to the light are illuminated. When toggled **off**, the light is non-exclusive, and is part of the **defaultLightList**. The default is **off**.

Shadows section

Raytrace Shadow attributes

Shadow Radius Used for creating soft shadows. Defines the size of the light for shadowing purposes only. Shadows are generated to match a globe-shaped light source, using the specified radius. For example, a light with a small shadow radius will produce a harder, high-contrast shadow because the light rays do not "spill under" objects; whereas a larger shadow radius lets light "spill under" objects, creating less of a distinction between what is illuminated and what is in shadow. This results in softer shadows.

Shadow Samples The number of shadow samples used to calculate a soft shadow. For example, if you have a light with a large Shadow Radius but a small Shadow Samples setting, the resulting shadow will not take advantage of the light's large Shadow Radius.

Ray Depth Limit The number of shadow rays required to make a shadow evident. For example, if a light does not cast the shadow you expect, the camera may be detecting several reflections and / or refractions so that it doesn't know where to cast the shadow. In this case, calculate the number of reflections and / or refractions this light is creating, starting from the place on the object where you expect a shadow to appear. The number of reflections and / or refractions you count, plus one, is the number to use as the Ray Depth Limit in order to get the shadow you expect.

See Chapter 2, "Optimizing Maya's Renderer," and "Raytracing shadows."

Depth map shadow attributes

See Chapter 4, "Using Depth Map Shadows."

4 Rendering an Animation

Rendering an animation requires more setup than simply rendering individual frames. Once a scene is saved, you must tell Maya to render it as an animation in the Render Globals attribute editor. You can select among standard animation render options such as start/end frames, file formats, extensions, and padding.

This chapter contains the following sections:

- "Rendering an animation."
- "Image file formats."

Rendering an animation

To render an animation:

1. Open an animation scene, and make sure it is saved.
2. Set the render quality for the scene (see Chapter 2, "Optimizing Maya's Renderer").
3. Open the Render Globals attribute editor, and in the defaultRenderGlobals tab, open the Renderable Objects + Cameras section.

   You can choose to render all the objects in your scene or just the active ones. You also must choose an image format (see Chapter 2, "Optimizing Maya's Renderer").
4. Select the view(s) you want to render (front, perspective, side, top).

   If you select more than one view, each one you choose will be rendered.
5. In the Animation section, turn on **Animation**.
6. Select one of the two kinds of Animation Range:

Start/End Uses the first and last frames in your scene as the start/end frames in the animation.

Render Globals Uses the **Start Frame** and **End Frame** and **By Frame Step** that you indicate.

You can also specify a **Start Extension**, **By Extension**, and **Extension Padding**, but these are optional. If you do not modify the extension, Maya will apply the default extension scheme, by number of frames in the animation.

7 Batch render the animation (see Chapter 9, “Batch Rendering”).

For information on how to view a scene after you render it, see Chapter 1, “The fcheck utility.”

Animation attributes (Render Globals)

Animation Renders a sequence of frames when turned on. When turned off, only one frame is rendered.

Animation Range Must be used with **Animation** toggle turned on. You can choose between setting your own **Start Frame** and **End Frame** in **Render Globals**, or you can use **Start/End**, which uses the first and last frames in the Timeline.

Start Frame The frame you want to be the first frame in a sequence.

End Frame The frame you want to be the last frame in a sequence.

By Frame Step The step or interval of frames in the sequence.

Modify Extension When turned on, lets you change the extension of the rendered frames to anything you want.

Start Extension The start extension number when you use **Modify Extension**.

By Extension The step or interval of frames in the sequence when you use **Modify Extension**.

Extension Padding Any frame padding you choose to use.

Motion Blur Turns on motion blur attributes, which are used to tune aliasing (see “Anti-aliasing” on page 19).

Motion Blur By Frame See “Anti-aliasing” on page 19.

Output Extensions

Use Maya File Name Uses the name of the scene as the prefix in each rendered frame’s name.

Use Frame Ext Must be used in conjunction with **User Input** in the **Out Format Control** menu. Can be any format extension you choose.

Note

When naming files for an animation, avoid using periods. Instead use underscores. For example, use

`xxx_yyy.sgi.1`

instead of

`xxx.yyy.sgi.1`

Out Format Control

As Output Format Uses the default Maya output format.

None Does not use a format extension.

User Input Lets you specify any out format you choose.

Output Format Ext **User Input** must be Selected. You can use any extension you want, for example, .pix.

Field Ext Control Lets you specify None, or the standard .o and .e field extensions, or custom field extensions.

Odd/Even Field Ext o and e are the default values, but you can use any characters you want to distinguish the even and odd fields.

Special Effects (Render Globals)

Ignore Film Gate When turned off, the film gate is respected if it intersects the viewport. When turned on, the film gate is ignored and every pixel is rendered.

Gamma Correction Gamma correction value.

Composite See “Compositing rendered images.”

Composite Threshold See “Compositing rendered images.”

Clip Final Shaded Color See “Compositing rendered images.”

Environment Fog See “Env Fog.”

Enable Depth Maps See “Turning depth map shadows on and off.”

Resolution attributes (Render Globals: defaultResolution)

Aspect Lock When turned on locks, the aspect ratio between the resolution width and height, so that if one is modified, the other maintains the correct aspect.

Width/Height The image resolution width and height.

Lock Device Aspect Ratio When turned off, makes sure that there is no squeeze in the outputted image.

Device Aspect Ratio The resolution must squeeze the image into this aspect ratio, which may be different from the resolution's aspect ratio.

Fields Specifies if you are going to use fields.

Odd Field First Specifies if an odd field is first.

Zeroth Scanline Specifies if the top or bottom is going to be used as the zeroth field.

Image file formats

The **Image Format** menu in the Render Globals attribute editor contains the list of formats available for image file output. The default format is Maya IFF, but you can output to any file format listed in this menu. All formats, unless otherwise indicated below, put Depth into a single file in the */depth* directory.

GIF Graphics Interchange Format is a data stream-oriented file format used to define the transmission protocol of LZW-encoded bitmap data. GIF images may be up to eight bits (256 colors) in depth and are always compressed.

SoftImage RGB plus Alpha in one file, which goes in the */images* directory.

RLA A Wavefront image file format that is an indexed scanline file. RGB, Alpha, and depth all go into one file. Images with this format are stored in the */images* directory. This format is also recognized by Composer.

Tiff Tag Image File Format, contains RGB plus Alpha in one file, which goes in the */images* directory.

Maya generates tiff files that use TIFF-5.0 LZW compression. To generate uncompressed tiff files, set the following environment variable before starting Maya:

```
setenv IMF_TIFF_COMPRESSION none
```

Uncompressed tiff files should be used when you intend to read the images into applications which require uncompressed images such as ZaP!It. Uncompressed tiff files should also be used when files are being generated for Studio, Power Animator, or any other application that supports the tiff 4.0 specification.

Tiff16 Same as Tiff, but supports 16 bits per color component.

SGI RGB and RGBA, in a single file in the */images* directory.

Alias Pix Three different file destinations possible: RGB into the */images* directory; Alpha into the */mask* directory; and depth into */depth* directory.

Maya IFF RGB, Alpha, and depth all go into one file. Images with this format are stored in the */images* directory. This format is also recognized by Composer.

Warning

RGB plus Depth is not recognized by Composer.

JPEG Joint Photographic Experts Group, a standard of the data compression of still pictures, usually with pictures coded to the CCIR 601 standard. JPEG uses DCT and offers data compression of between 5 and 100 times. Three levels of processing are defined: baseline; extended; and lossless encoding.

EPS Encapsulated PostScript file format.

Maya16 IFF Same as Maya IFF, but supports 16 bits per color component.

Cineon The Cineon image file format, in which no mask is generated.

Quantel The Quantel image file format outputs to YUV. Only NTSC and PAL resolutions are supported (720X486; 720X576); any other resolution defaults to IFF. Valid YUV field images will not be created by Maya, even though you can tell Maya to create YUV fields.

Warning

The Quantel file format has only 220 levels, which makes it very sensitive when viewed on an RGB monitor.

Notes

When you are outputting to Composer or Zapit!, before you render you must type the following in a UNIX shell:

```
setenv MAYA_REVERSE_FILEFORMAT_EXT
```

If you render to an 8-bit / pixel format, the final color is jittered slightly to reduce quantization artifacts. To turn this off, type the following in a UNIX shell:

```
setenv MAYA_NO_JITTER_FINAL_COLOR
```

5 Using the Shading Group Editor

The Shading Groups Editor gives you control over which geometric objects or their components are assigned to separate shading groups. This editor is primarily used for assigning polygonal facets to separate shading groups.

This chapter contains the following sections:

- "Understanding the Shading Group Editor" on page 67
- "Creating shading groups" on page 69
- "Selecting shading groups" on page 70
- "Adding items to a shading group" on page 71
- "Removing items from a shading group" on page 71
- "Renaming shading groups" on page 72
- "Changing the color assignment" on page 72
- "Using the Shading Groups Editor" on page 73
- "Menu items in common with the Set Editor" on page 74

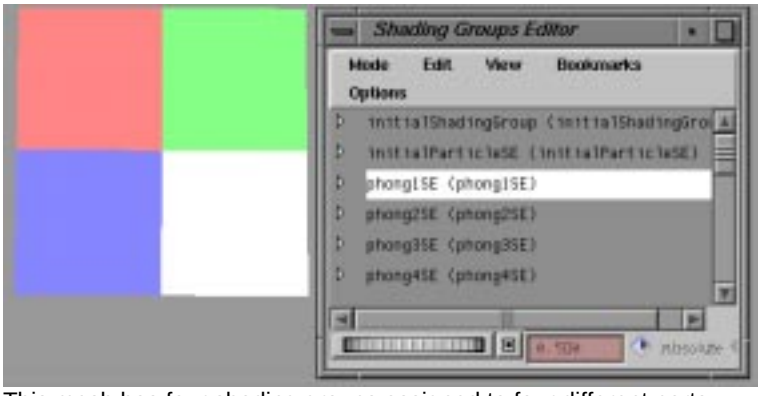
Understanding the Shading Group Editor

Shading groups can be created in the Shading Groups Editor or in the Multilister. When you create a shading group, you can automatically see it in relation to other shading groups.

The Shading Groups Editor works differently from the Set Editor. Shading groups cannot overlap one another—a shading group cannot include all or part of the geometry contained in another shading group. This means that components such as facets can belong only to a single shading group at a time. Unlike the Set Editor, it is easy to tell which facets are in which shading group. This is an important distinction vis-à-vis the Set Editor. Thus, the Shading Groups Editor fits well into the modeling and rendering workflow—the simple materials assigned to the shading groups of an object during modeling can easily be reassigned to more complex materials for the

final rendering. Using the Shading Groups Editor also makes it easy to complete the material assignments for final rendering because the parts of the geometry to be assigned a particular material.

By default, all components of an object that do not belong to a shading group are gathered in a global group called the initial shading group. You can freely use the components in this holdall as the basis for creating further shading groups. So a component can belong either to the initial shading group or to a separate shading group but not to two shading groups at the same time. Unfortunately, removing items from a shading group using the Set Editor does not return them to the initial shading group. If that's all you need, though, the Set Editor works well. When you remove an item from a shading group using the Set Editor, the item does not show through in the modeling view whereas when you remove an item from a shading group using the Shading Groups Editor, an outline of where the removed item was appears and is therefore easier to notice.



This mesh has four shading groups assigned to four different parts. So a facet has only one material assigned to it.

Tip

So the use of shading groups is a good choice if you want to visually distinguish the different parts of a model before further refining the material assignment for final rendering. As you make your model, you will notice certain parts that you'll want to develop further; perhaps it's the skin, eyebrows, lips, or clothes. Consider creating a shading group for each part you will be modeling. Using the Shading Groups Editor allows you to quickly identify one part of your model from another without waiting to render it because each part of your model belongs to a separate shading group.

Creating shading groups

You first make a geometric object such as a polygon. For example, the shading group shown here was created from a polygonal plane primitive. You then arrange parts of the object into the shading group you want.

To create a shading group:

1. Select an object whose components you want to group as a single unit.
2. Select a component.

   For example, click the **Select by component type** button and click the right mouse button on the **Facets** button to select **Facets** from the pop-up menu (F11) or click the right mouse button on the object in a view and select **Facet** from the pop-up menu.
3. In a view, click and drag the left mouse button over the components such as facets that you want to form the shading group.

   Initially, all components are in the initial shading group and you usually select components in it for making new shading groups. However, if the components you select are already part of another shading group, then you can use **Edit** → **Create Shading Group (force)** to force these components to belong to the new shading group, removing them from the original shading group.
4. Open the Shading Groups Editor window by selecting **Window** → **Rendering Editors** → **Shading Groups Editor** or **Window** → **Shading Groups Editor** from the Multilister.

If no shading group has been created in your scene yet, you will see only the initial shading group item in the list.

5 Select **Edit** → **Create Shading Group**.

The facets become a single group and are automatically shaded in the modeling view provided that the shaded display mode is turned on (select **Shading** → **Smooth Shade All** from the view menu bar or press 5). Because the **Assign Color to New Groups option** is on by default, the shading group is automatically colored in the modeling view.

Selecting shading groups

You can select shading groups with or without their contents depending on the mode you choose.

To select without contents:

1 Select **Window** → **Rendering Editors** → **Shading Groups Editor** to display the Shading Groups Editor window.

2 Select **Mode** → **Select**.

A list of shading groups is displayed. Then you can select a particular shading group to do some operation on it, for example shading groups can be renamed as their number increase or you can modify attributes of the shading group in the Attribute Editor (**Window** → **Attribute Editor**).

To select by contents:

1 Select **Window** → **Rendering Editors** → **Shading Groups Editor** to display the Shading Groups Editor window.

2 Select **Mode** → **Select Contents**.

The list of all available shading groups appears in the Shading Groups Editor window.

3 Click a shading group you want in the list and its contents is displayed in the modeling view.

You can also select the contents of consecutive shading groups by pressing Shift.

To display and edit shading groups by contents:

1. Select **Window** → **Rendering Editors** → **Shading Groups Editor** to display the Shading Groups Editor window.
2. Select **Mode** → **Editing**.
3. Click the triangle to the left of a shading group to see its contents.

   When the triangle is pointing down, the shading group is expanded and you can view and edit each of the members in the shading group.

Adding items to a shading group

To add items to a shading group:

1. Select a component.

   For example, click the **Select by component type** button and click the right mouse button on the **Facets** button to select **Facets** from the pop-up menu (F11) or click the right mouse button on the object in a view and select **Facet** from the pop-up menu. You can add only polygonal facets or whole objects to a shading group.
2. In a view, click and drag the left mouse button over the components such as facets that you want to add to the shading group.
3. In the Shading Group Editor, click the name of the shading group.
4. Select **Edit** → **Add items**.
5. The selected items are added to the shading group and are no longer in the initial shading group.

   By selecting **Add Items (force)**, you can force items to be added to a shading group.

Removing items from a shading group

The shading group is eliminated but the geometry is not.

To remove items from a shading group:

The items you remove from the shading group you are editing are put back in the initial shading group.

1. Select a component.

For example, click the **Select by component type** button and click the right mouse button on the **Facets** button to select **Facets** from the pop-up menu (F11) or click the right mouse button on the object in a view and select **Facet** from the pop-up menu.

2. In a view, click and drag the left mouse button over the components such as facets that you want to remove from the shading group.
3. In the Shading Group Editor, click the name of the shading group.
4. Select **Edit** → **Remove items**.
5. The selected items are removed from the shading group and put back into the initial shading group.

Renaming shading groups

You can rename any existing shading groups.

To rename a shading group:

1. Click the name of the shading group

   This highlights the shading group.
2. Select **Edit** → **Rename Shading Group**.

   A window appears where you can enter a new name.
3. Enter new name for the shading group.

   The renamed shading group will now be available in the Shading Groups Editor window.

Changing the color assignment

Shading groups are automatically colored. By default, **Assign Color to New Groups** in the **Options** menu is turned on.

To change the color:

More varied effects can be created by assigning the shading group to a material such as a Phong.

1. With both the facets you want to group in the modeling view and the shader engine in the Multilister selected, use **Edit** → **Assign** in the Multilister.

The newly created shading group is assigned for example to the color of the material you assign or to any texture you want.

2 To see the color or the texture map on the shading group in a modeling view, select **Shading** → **Hardware Texturing** (press 6).

3 To change the color of the shading group, click the **Color** of the material under the Common Material Attributes section of the Phong material for example and then choose the desired color from the color chooser.

With the shading group attributes showing the Attribute Editor (select **Mode** → **Select** and then **Window** → **Attribute Editor**), you can re-assign another material to the shading group.

Assigning a single material to many shading groups

One slick thing you can do with the **Assign Color to New Groups** in the **Options** menu is turn it off. Say you have 100 objects in your scene and you want each object to be lit using a separate light without having to assign 100 materials to 100 separate shading groups. Turn off **Options** → **Assign Color to New Groups** and use **Edit** → **Create Shading Group** as you normally would. As you create shading groups, they are all assigned to a single material such as a Phong. By default, this is the material assigned to the initial shading group. When you are ready to use the light lists or other properties, you can get all those objects lit using the light lists of the different shading groups even though only a single material is used for all the shading groups.

Using the Shading Groups Editor

Clicking the left mouse button on items in the menu bar gives you access to the commands. You can also access these commands by clicking the right mouse button within the window to display the pop-up menus.

Mode menu

Once you select a shading group, you can select one of three modes for manipulating it:

Editing Lets you modify the selected shading group.

Select Contents Shows the geometry assigned to a shading group.

Select Selects shading groups.

Edit menu

Choose any of the following:

Create Shading Group Includes the selected polygonal facets into a shading group unless the selected items are already assigned to a non-default shading group.

Create Shading Group (force) Forces selection in the newly created shading group even if it is already assigned to a shading group other than the initial shading group. Because a component can belong to only one shading group at a time, the items are removed from the original shading group and placed in the new shading group that you are going to create.

Add Items Adds selected items to the shading group that is currently selected.

Add Items (force) Adds selected components to the currently active shading group even if they are already in a shading group other than the initial shading group. Because a component can belong to only one shading group at a time, the items are removed from the original shading group and placed in the new shading group that you are adding to.

Remove Items Removes selected items from the currently selected shading group and puts them back in the initial shading group.

Delete Shading Group Deletes the selected shading group.

Rename Shading Group Renames the selected shading group.

Shading Group Attributes Displays the Attribute Editor.

Options menu

Assign Color to New Groups Each time you create a new shading group, it is colored, making it easy to distinguish from other shading groups.

Menu items in common with the Set Editor

Because the rest of the menu options are the same as for the Set Editor, see the Sets part of the *Using Maya: Hypergraph, Sets & Expressions* book for details on sets.

6 Using the Connection Editor

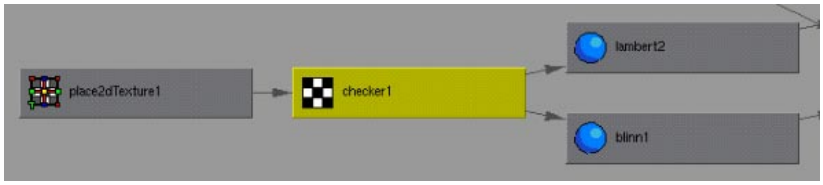
This chapter contains the following sections:

- “Loading the Connection Editor” on page 76.
- “Navigating a node network” on page 76
- “Making connections” on page 78.
- “Breaking connections” on page 84.
- “Connection Editor menu and button options” on page 85.

The **Connection Editor** presents node network information in a side-by-side layout, which allows you to view two nodes that are connected in a node network.

You can make and break shading network connections in the **Connection Editor**. This editor is particularly useful for fine-tuning a shading network. The **Connection Editor** is the best a tool for making non-default connections because you can easily and quickly traverse from node to node in a network. You can configure the **Connection Editor** to show you a node’s outputs or inputs, which means you can make connections in either direction in a node network.

In the **Connection Editor**, you can navigate up a network to a fork, and then navigate down a different prong, as in the case where you have a texture outputting to two shading groups.



This view of the Hypergraph shows a checker texture node outputting to two shading groups. Using the Connection Editor, you can navigate and make connections anywhere along the node’s network.

Loading the Connection Editor

Before you can make or break connections between two networked nodes, you need to load the **Connection Editor** with the node network. There are four ways to load the **Connection Editor**:

From the Multilister

In the Multilister, use the middle mouse button and Shift-drag one node onto another node (for example, drag a texture onto a shader). This action loads the two nodes to the left and right sides of the editor, respectively.

Drag from Multilister to Connection Editor

In the Multilister, use the middle mouse button to drag a node into the left or right side of the **Connection Editor**.

Drag from one side to the other

In the **Connection Editor**, use the middle mouse button to drag a node from one side to the other.

Using the Reload Left/Right buttons

Loads the currently selected node into the left or right side of the editor.

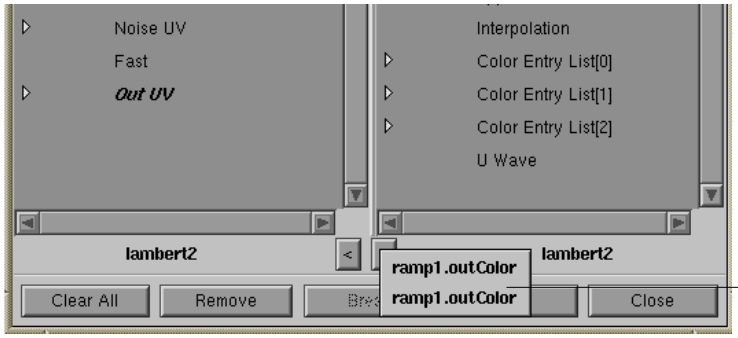
Navigating a node network

When you load a networked shading node into the left or right side of the **Connection Editor**, you can navigate up or down the node network, using either the navigating buttons or the right mouse button.

Using the Navigating buttons

The navigating buttons load the node upstream or downstream from the currently loaded node.

For example, when you load a networked shading node into the left side of the **Connection Editor**, you can use the right mouse button to click the right navigating button and see all the nodes that the selected node outputs to.

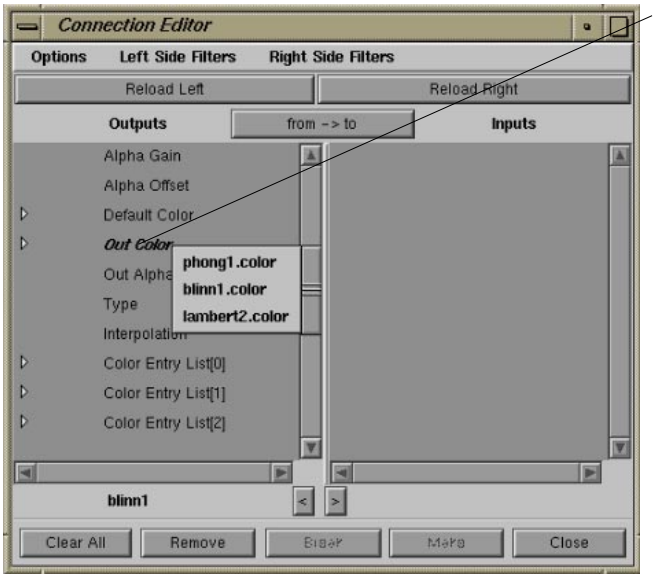


Use the right mouse button to click over the right navigating button to see all the downstream nodes in the network.

Using the right mouse button

You can click the right mouse button over a connected attribute to display a menu of connected nodes. Selecting one of the nodes loads the node into the **Connection Editor**.

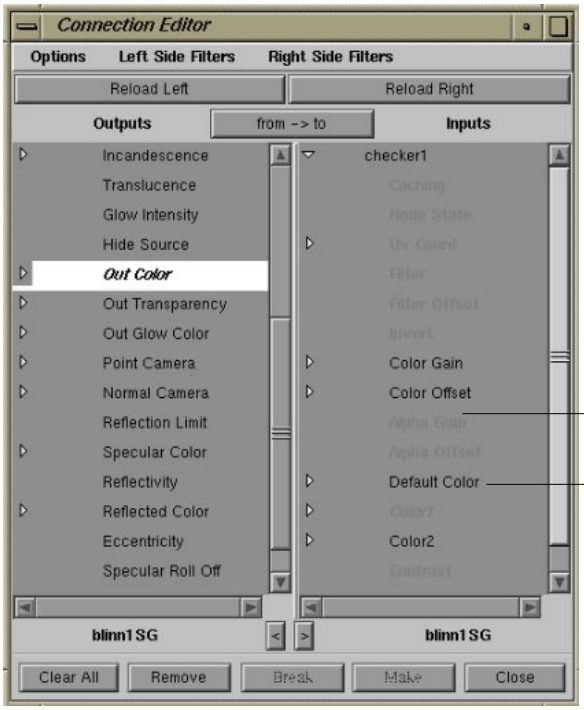
For example, if you have a Ramp texture connected to several shading groups, you can click the right mouse button over the ramp's **Out Color** and see the nodes that are in the network. Selecting one of the nodes loads it into the right side of the editor.



Position the pointer over the Out Color attribute text, and use the right mouse button to display a list of the nodes that are in the network. Selecting one of the nodes in the list loads the node into the Inputs side of the Connection Editor.

Making connections

You can explicitly connect any two compatible attributes using the **Connection Editor**. For example, you can connect a particular texture attribute to a particular material attribute. When you highlight an attribute in the **Output** side, all the compatible (or valid) attributes are listed on the **Input** side. Non-compatible attributes are disabled, as shown below.



Note

Some attributes are compound, meaning that several attributes together form a larger attribute (for example, **Out Color** is a compound attribute that is made up of **Out Color R**, **Out Color G**, and **Out Color B**). Just because a compound attribute is disabled, does not mean that the attributes that form it are also disabled. You must can expand the compound attribute to see if all the attributes within it are disabled or compatible.

Making connections: The procedure

You have the option of making connections either manually or automatically. See “Options menu” on page 85.

To make connections using the Connection Editor:

1. In the Multilister, press Shift and use the middle mouse button to drag a texture onto a shading group (see “Quick tour of the Multilister” on page 19).

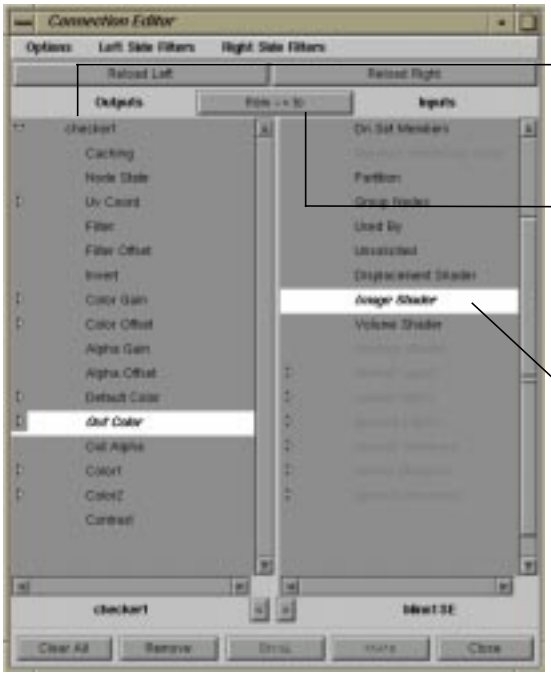
   The **Connection Editor** appears and displays the output attributes of the texture and the input attributes of the shading group.

2. Click on any attribute on the **Output** side of the editor.

   The **Input** side displays all the valid attribute connections that can be made. Nonvalid **Input** connections are disabled.

3 Click on any valid attribute on the **Input** side of the editor.

The highlighted text changes from normal to bold-italics, indicating that the connection is made.



The checker texture is the upstream node, and it provides the output attributes to the shading group node.

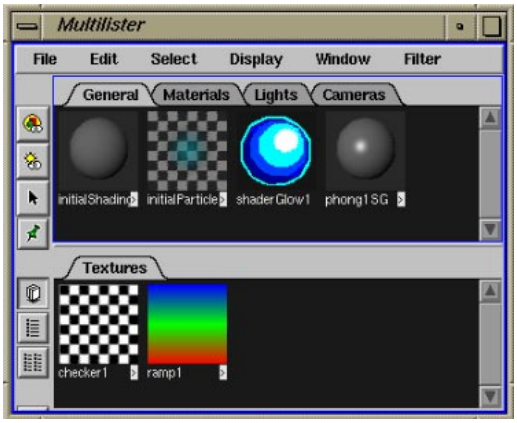
You can change the direction of the connections shown by clicking the from → to button.

When you make a connection between an output attribute and an input attribute, the input attribute text changes from normal to bold-italics.

Making connections: an example

To connect ramp outcolor to checker color1:

1 Create a phong shading group, a checker texture, and a ramp texture using the Create Render Node window (in the Multilister, select **Edit** → **Create...**).



2 Use the middle mouse button to drag the checker texture onto the phong shading group.

The phong shading group icon changes to reflect the checker texture's input.

3 Expand the phong shading group so you can see the phong material icon and the checker texture icon.

4 Press Shift and use the middle mouse button to drag the ramp texture icon in the **Textures** tab onto the checker texture in the **General** tab.

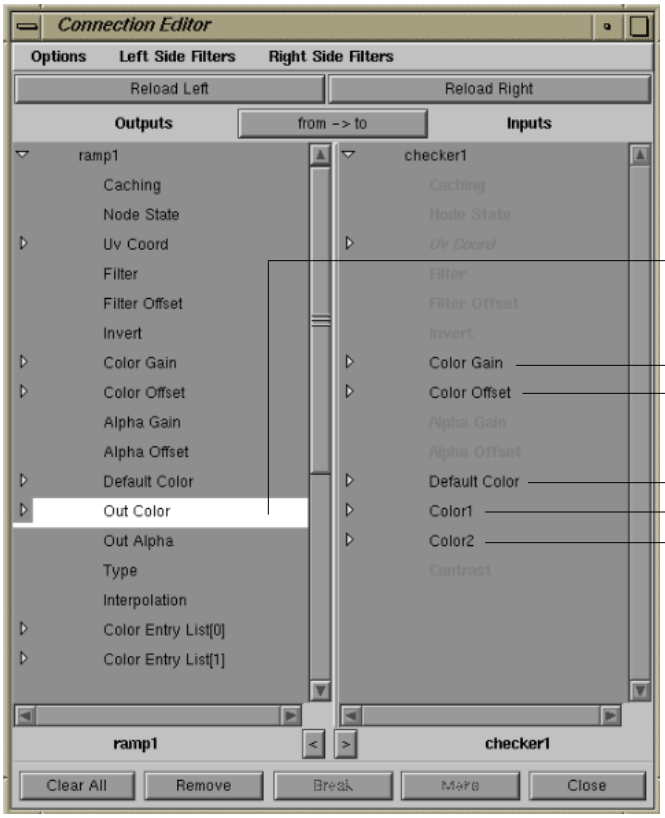
The **Connection Editor** is displayed, with the ramp attributes on the left (**Output** side) and checker attributes on the right (**Input** side).

Tip

You can also use the middle mouse button and drag the ramp texture onto the checker texture in the **Textures** tab of the Mulitilister.

5 Click on the ramp's **Out Color** attribute.

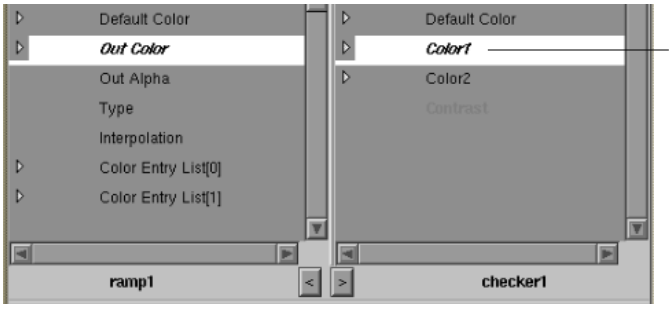
The compatible (or valid) attribute connections you can make to the checker texture are enabled.



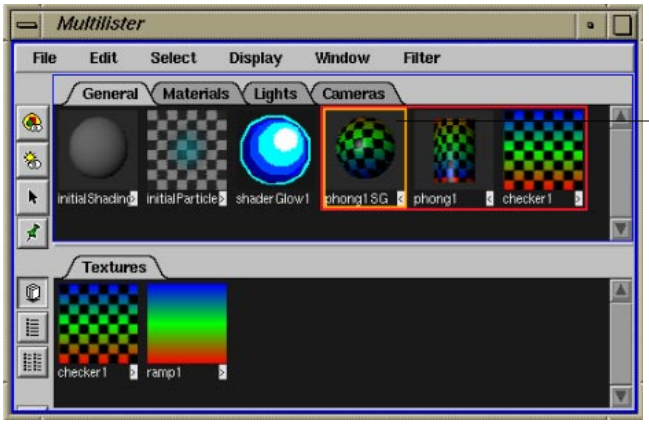
Click here to see the checker's valid input connections from the ramp.

These are the checker's valid input connection attributes for the ramp's Out Color.

6 Click the checker texture's **Color1** attribute to connect it to the ramp texture's **Out Color**.



The checker's Color1 attribute text changes from normal to bold-italics, indicating that the connection between it and the ramp's Out Color is made.



The result is that the ramp's Out Color is mapped to the checker's Color1 input.

Breaking connections

You break connections the same way you make them. You have the option of breaking connections either manually or automatically. (see "Options menu" on page 85).

To break a connection using the Connection Editor:

1 Open the **Connection Editor** by pressing the Shift key and using the middle mouse button to drag a texture onto a shading group.

The **Connection Editor** is displayed.

2 Select the **Output** attribute of the connection you want to break.

The Input attribute of the connection is highlighted.

3 Click on the highlighted text of the Input attribute to break the connection.

The text changes from bold-italics to normal when the connection is broken.

Tip

To make or break connections manually, select **Options** and toggle OFF **Auto-connect**. The **Break** and **Make** buttons become enabled, and you can use them to manually make and break connections.

You can also break connections in the attribute editor, by placing the right mouse button over the label of the attribute you want to disconnect, and selecting **Break Connection**.

Connection Editor menu and button options

Options menu

Auto-connect When toggled on, lets you make and break connections automatically by clicking on input attributes.

When toggled off, lets you make and break connections manually by selecting attributes and using the **Break** and **Make** buttons to make and break connections.

Left/Right Side Filters menu

Show Readable Lists all the readable attributes (attributes that are outputs or both outputs and inputs).

Show Outputs Only Lists only the node's output attributes.

Show Inputs Only Lists only the node's input attributes.

Show Non-Keyable When toggled off, shows only the node's keyable attributes. When toggled on, shows both keyable and non-keyable attributes.

Show Connected Only Lists only the node's connected attributes.

Show Hidden When toggled off, hidden attributes are not shown. When toggled on, both hidden and visible attributes are shown.

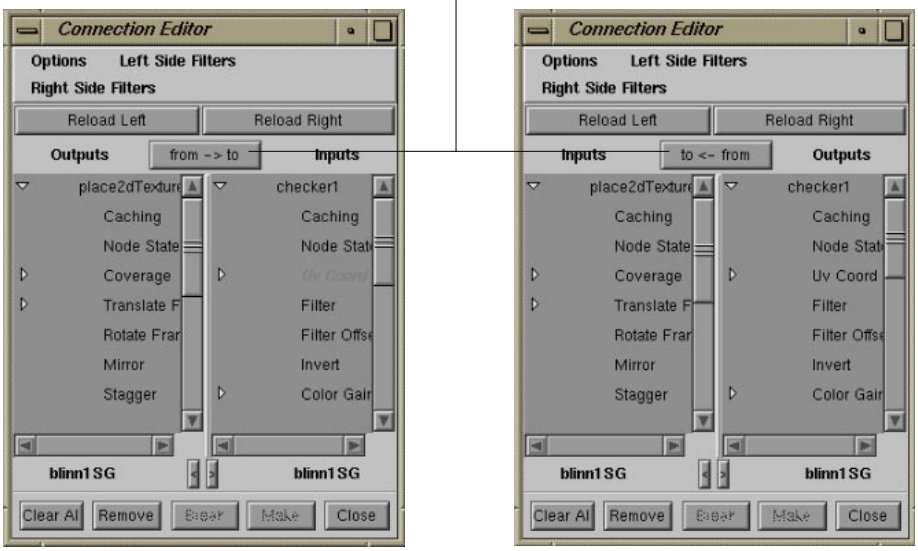
Reload Left/Right buttons

Load the currently selected node(s) into the left or right side of the editor.

from → to button

Changes the direction in which you make connections. By default, node outputs appear on the left side with node inputs on the right. Clicking the **from → to** button reverses this setup.

The from → to button changes the direction in which you make connections.



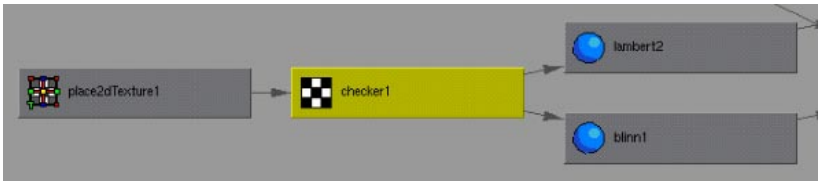
When the direction of the connection is from the left side to the right side, outputs are shown on the left and inputs are shown on the right side of the editor.

When the direction is reversed, inputs are shown on the left and outputs are shown on the right.

Notice that the checker's valid Inputs are different than its valid outputs.

Node network navigating buttons

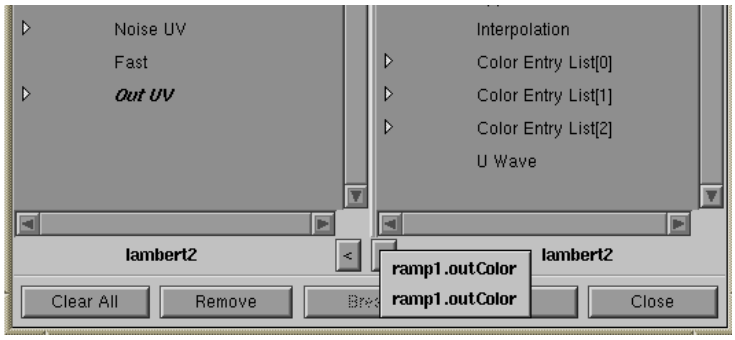
Load the next node in the node network into the **Input** and **Output** sides of the editor.



For example, if you have a phong material loaded in the right side of the editor, and you click the downstream button, the phong material gets loaded in the left side of the editor, and the phong shading group node is loaded into the right side.

Tip

You can click the right mouse button over the **Navigating** buttons to see what other nodes are connected in the node network, and to navigate to those nodes.



Clear All

Removes all the nodes from both sides of the **Connection Editor**.

Remove

Removes the node(s) from the side of the **Connection Editor** that was last selected. You can traverse upstream or downstream from the remaining node after you remove a node.

Break

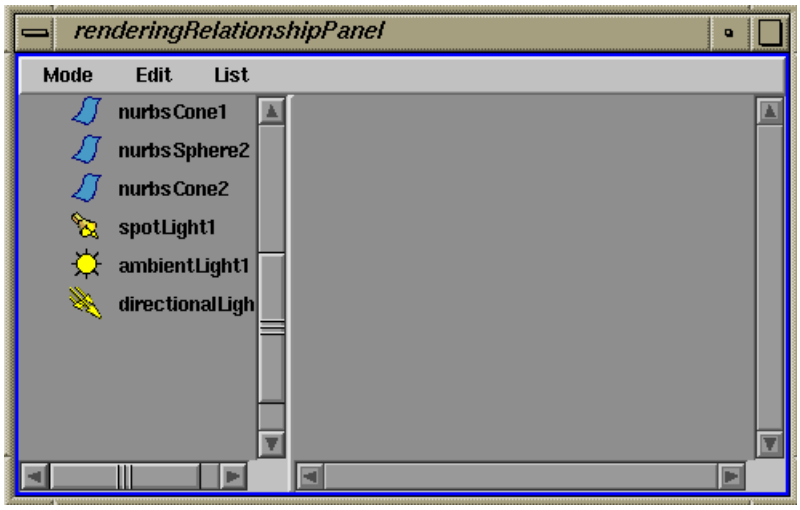
Allows you to manually break connections. **Options** → **Auto-connect** must be turned off in order for this button to work.

Make

Allows you to manually make connections. **Options** → **Auto-connect** must be turned off in order for this button to work.

7 Using the Relationship Panel

The Relationship Panel (**Lighting** → **Relationship Panel**) is a text-based tool that performs functions similar to the **Light Linking** and **Shading Group** tools located in the Multilister.



The Relationship Panel has many of the same features as the Outliner (**Windows** → **Outliner**, see *Using Maya: Basics*). In addition, you can use the Relationship Panel to select objects and lights in your scene. You can also create shading groups in the Relationship Panel.

The chapter contains the following sections

- "Selecting objects and lights" on page 90
- "Light linking" on page 90
- "Assigning shading groups to objects" on page 93

Selecting objects and lights

As with the Outliner, you can select objects and lights by using the Relationship Panel.

To select objects and lights:

1. Create a scene that has objects and lights.
2. Select **Lights** → **Relationship Panel**.

   Objects and lights in your scene are displayed on the left side of the panel. You can filter the left side of the panel so you only see the nodes you want to see (see the Outliner, in *Using Maya: Basics*).
3. Click on a light or an object.

   The light or object gets selected in the view. You can select many lights and objects at once by dragging over the ones you want to select (use Shift or Ctrl to select multiple, nonadjacent objects).

Light linking

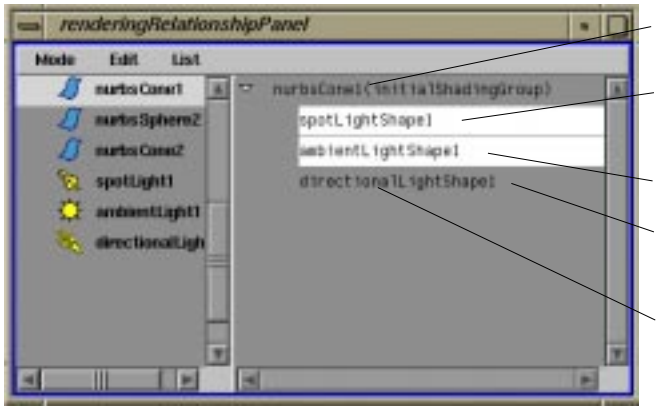
There are two ways to link lights in the Relationship Panel: using **Single Selection** or **Multiple Selection**.

To link lights using Single Selection:

1. Select **List** → **Single Selection** (you can also use the right mouse button in the right side of the panel).

2 Select **Mode** → **Light Lists**.

On the left side of the panel, lights and objects are displayed. When you select an object on the left side, the selected object and all the lights in the scene are displayed on the right side.



3 Click the text of a light on the right side to link it to the object. Click again to unlink it.

Note

Remember, lights are connected to shading groups, not to objects, so the objects you see listed on the left side are actually objects that are assigned to shading groups.

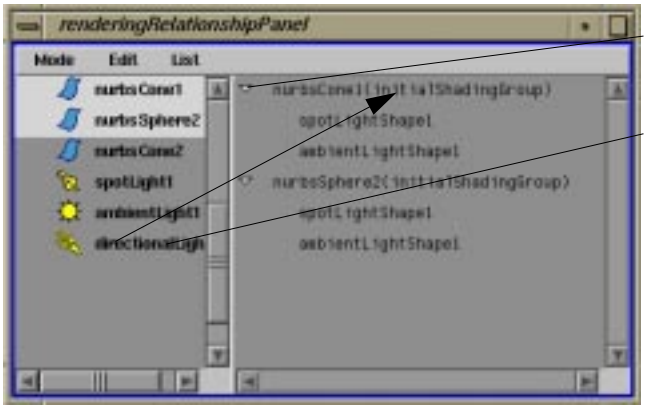
To link lights using Multiple Selection:

1 Select **List** → **Multiple Selection** (you can also use the right mouse button in the right side of the panel).

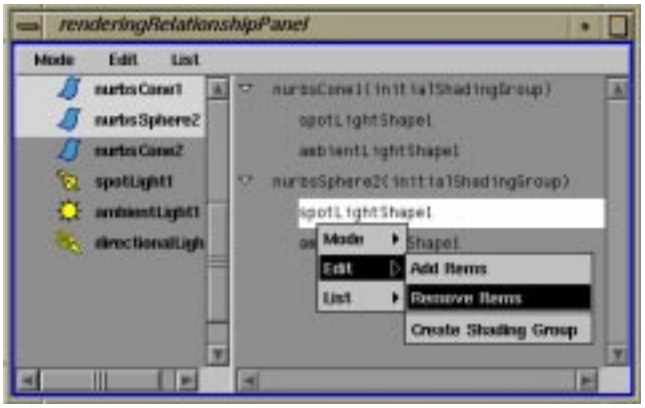
2 Select **Mode** → **Light Lists**.

3 Select one or multiple objects on the left side of the panel (use Shift or Ctrl to select multiple, nonadjacent objects).

The objects are displayed on the right side of the panel. When you expand them, the lights that are linked to them are displayed.



4 To link a light to a shading group, use the middle mouse button to drag a light from the left side onto the text of the object on the right side. You can also drag lights from object to object on the right side of the panel. To unlink lights, select the light, then use the right mouse button to select **Edit** → **Remove Items**.



Assigning shading groups to objects

You can create shading groups and assign them to objects in the Relationship Panel.

To create a shading group:

1. Select **Lighting** → **Relationship Panel**.
2. Select List, and turn on **All Shading Groups**.
3. In the Relationship Panel, select **Edit** → **Create Shading Group** (you can also use the right mouse button in the right side of the panel).

   The new shading group is displayed on the right side of the panel, labeled Set1, Set2, and so on. You can change the label by double-clicking on it, and typing a new name. Press Enter to accept the new name.

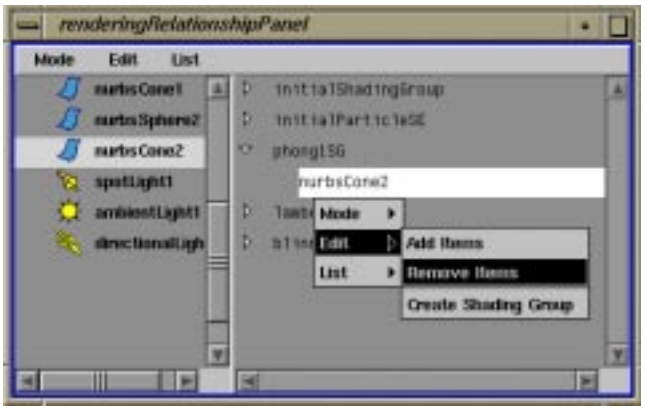
   You can assign the shading group to an object (see below).

To assign a shading group to an object:

1. Select **List** → **Multiple Selection**, and turn on **All Shading Groups**, so you can see all the shading groups you create and those already created.
2. Select **Mode** → **Shading Lists**.

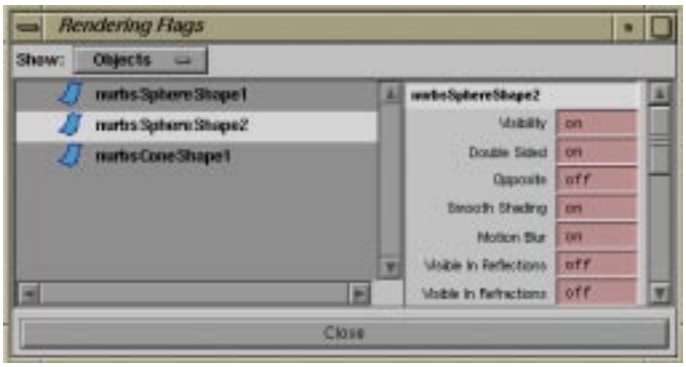
3 Select an object on the left side of the panel, for example, a nurbsShpere. Use the middle mouse button to drag the object onto a shading group's text in the right side of the panel. You may have to expand the shading group to see the object.

The shading group is now assigned to the object. To unassign a shading group, highlight the object on the right side of the panel, and use the right mouse button to select **Edit** → **Remove Items**.



8 Rendering Flags

The Rendering Flags window (**Window** → **Rendering** → **Editors Render Flags**) lets you select objects, textures, lights, materials, and so on. You can also set the attributes for these nodes.



This chapter contains the following sections:

- "Selecting objects, textures, and materials" on page 95
- "Setting Rendering Flags" on page 96

Selecting objects, textures, and materials

You can select objects, lights, dynamics, cameras, textures, and materials. The procedure is the same for all.

To select objects:

1. Open a scene.
2. Select **Window** → **Rendering Editors** → **Rendering Flags**.
3. In the **Show** menu, select the node category you want to display, for example, **Objects**.

   The objects in your scene are displayed on the left side of the panel.
4. Select an object by clicking its label.

The object is selected in the views. You can select multiple, nonadjacent objects using the Shift or Ctrl keys.

The object's flags, or attributes, are displayed on the right side of the panel.

Setting Rendering Flags

You can set rendering flags, or attributes of objects, lights, dynamics, cameras, textures, and materials. The panel is similar to the Outliner (see Outliner in *Using Maya: Basics*).

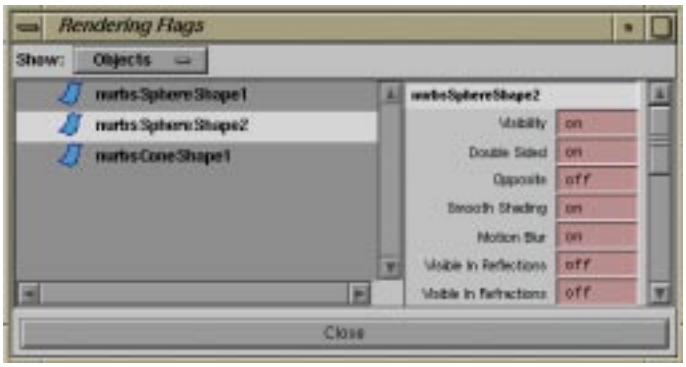
To set attributes:

1. Open a scene.
2. Select **Window** → **Rendering Editors** → **Rendering Flags**
3. In the **Show** menu, select the node category you want to display, for example, **Objects**.

   The objects in your scene are displayed on the left side of the panel.
4. Select an object by clicking its label.

   The object is selected in the views. You can select multiple, non-adjacent objects using Shift or Ctrl keys.

   The object's flags, or attributes, are displayed on the right side of the panel.



5. On the right side of the panel, you can turn attributes on or off and set numerical values.

Note

You can also set rendering attributes in the Spreadsheet, in render node attribute editors, and in the Channel Editor.

9 Batch Rendering

This chapter contains the following sections:

- "Batch rendering from the command line" on page 99
- "Batch rendering within Maya" on page 102

Batch rendering allows you to render a series of images in an animation. Use the batch render option when you are ready to render an entire animation using the full power of your workstation. The batch renderer does not require the use of Maya's user interface.

Since batch rendering consumes memory, we do not recommend that you perform batch rendering concurrently with an interactive Maya session.

You can batch render within Maya or from the UNIX command line.

Batch rendering from the command line

Ideally, perform your batch rendering on a dedicated machine from the command line. This allows you to continue working in Maya on another machine while you perform the batch render. You can specify a number of options from the command line. See the table on the following pages for a complete list of batch render options.

To batch render from the command line:

At the command prompt, type:

```
Render <options> <filename>
```

where <filename> is (generally) a Maya ASCII or Maya Binary file, and <options> is one or more of the options in the following table:

Use...	For...
-s <float>	start frame for the rendered animation sequence
-e <float>	end frame for the rendered animation sequence

Use...	For...
-b <float>	by frame for the rendered animation sequence
-be <int>	by extension (or step) for the output image frame file name extension
-se <int>	starting number for output image frame extensions
-rd <path>	the directory to store pix / depth file
-im <filename>	image file output name
-p <filename>	image file output name (identical to -im)
-me <boolean>	append Maya filename to image name
-mf <boolean>	append image file format to image name
-d <filename>	depth file output name
-ar <float>	aspect ratio for the rendered image
-sa <float>	shutter angle for motion blur (1-360)
-uf <boolean>	use the tessellation file cache
-oi <boolean>	dynamically detects similarly tessellated surfaces
-rut	reuse render geometry to generate depth maps
-edm <boolean>	enable depth map usage
-ert <boolean>	enable raytracing
-rfl <int>	maximum raytracing reflection level
-rfr <int>	maximum raytracing refraction level
-sl <int>	maximum raytracing shadow ray depth
-eaa <quality>	the anti-aliasing quality of EAS (Abuffer). One of: highest, high, medium, or low
-ufil <boolean>	in on, use the multi-pixel filtering, otherwise use single-pixel filtering
-ss <int>	global number of shading samples per surface in a pixel

Use...	For...
-mss <int>	maximum number of adaptive shading samples per surface in a pixel
-mvs <int>	number of motion blur visibility samples
-mvm <int>	maximum number of motion blur visibility samples
-vs <int>	global number of volume shading samples
-pss <int>	number of particle visibility samples
-rct <float>	red channel contrast threshold
-gct <float>	green channel contrast threshold
-cct <float>	pixel coverage contrast threshold (default is 1.0 / 8.0)
-cam <camera_name>	all subsequent -im -p -d -ar -sa flags apply only to <camera_name>
-g <float>	gamma value
-ifg <boolean>	use the film gate for rendering
-ih <int>	height of image in pixels
-iw <int>	width of image in pixels
-mm	allows you to specify the maximum memory used by the renderer
-mb <boolean>	motion blur on / off
-mbf <float>	motion blur by frame
-of <format>	output image file format (one of the following: gif, si soft softimage, rla wave wavefront, tiff tif, tiff16 tif16, sgi rgb, alias als pix, iff tdi explore, jpeg jpg, eps)
-pad <int>	number of digits in the output image frame extension
-verbose <boolean>	perform the render verbosely if on
-x <int>	set the X resolution of the final image
-y <int>	set the Y resolution of the final image
-xl <int>	set the X subregion left pixel boundary of the final image

Use...	For...
-xr <int>	set the X subregion right pixel boundary of the final image
-yl <int>	set the Y subregion low pixel boundary of the final image
-yh <int>	set the Y subregion high pixel boundary of the final image

Batch rendering within Maya

Use **Batch Render** to batch render small or test scenes from within Maya. For larger scenes, batch render from the command line (see "Batch rendering from the command line" on page 99).

For information on how to view a scene after you render it, see Chapter 1, "The fcheck utility."

To batch render from within Maya:

1. Choose **Render** → **Batch Render**

   The **Batch Render** window is displayed.

2. Enter the name of a Maya file you want to have written from to batch render, and click **Batch Render**.

   By default, Maya renders the animation images into the */images* directory. The status of the rendering appears in the status bar in the lower right corner of the Maya window.

To batch render on a remote machine:

1. Save your scene.
2. Select **Render** → **Batch Render** - ❒.

3. Type the name of the machine on which you intend to render.

4 Select a **Rendering CPU**, either **Local** or **Remote** (this determines which machine's processor is used).

5 Click **Batch Render**.

The **Batch Render (default)** window is displayed.

6 Type the name of the file you want to batch render. If you type the same name you saved in Step 1, Maya will prompt you to confirm you want to overwrite that file. Type a new name if you want to render the file under a different name.

7 Click **Batch Render**.

Watch the status line for the status information about the render.

To view the batch render:

Choose **Render** → **Show Batch Render**.

The view render window is displayed. You can now watch individual frames of a batch render during the rendering process.

To cancel the batch render:

Choose **Render** → **Cancel Batch Render**.

Maya prompts you to confirm. You can cancel a batch render at any time.

10 Using Image Planes

You can attach image planes to a perspective camera in an animation to create depth of field in a scene. You can also attach them to an orthographic camera and use them for modeling or rotoscoping. An image plane is useful only once you attach it to a camera. Start by creating a camera for the scene, then create an image plane and attach it to the camera you created.

This chapter contains the following sections:

- "Creating a camera" on page 105
- "Attaching an image plane" on page 107
- "Loading an image" on page 110
- "Deleting image planes" on page 110
- "Loading a scene in the image plane" on page 111
- "Image plane attributes" on page 113

Creating a camera

You can create one, two, and three-node cameras in Maya. With a one-node camera, you can animate the orientation and position. With a two-node camera, you can animate the position and look at point of the camera.

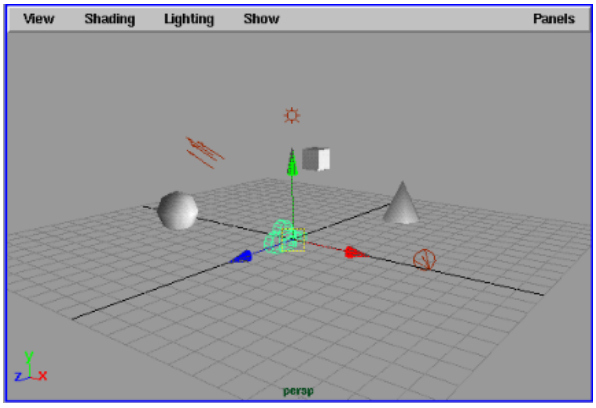
To create a one-node camera:

You can create cameras within Maya in one of two ways:

From the Primitives menu

Select **Primitives** → **Create Camera**.

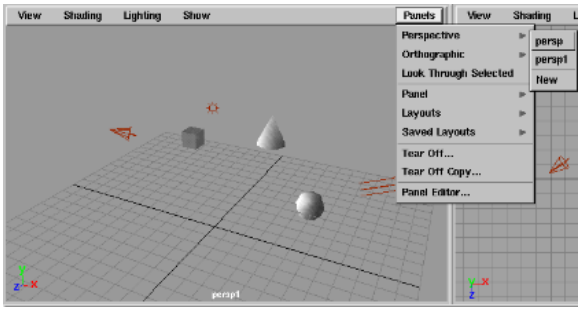
A camera appears at the origin in the views, with the translate manipulators displayed so you can immediately position the camera where you want it.



From the Panels menu

- In a view, select **Panels** → **Perspective** → **New**.

  A camera is created, and you are automatically looking through the new camera, so the view is labeled **persp1**. To look through the default persp view so you can see the camera you just created, select **Panels** → **Perspective** → **persp**. You can translate the new camera by entering X, Y, and Z values in the translate fields of the **Channel Box**.



To create a two-node camera:

1. Select **Primitives** → **Create Camera -** ❐.

   The **Create Camera Options** window is displayed.

2. In the **Animation Options** section, select the **Two** node radio button.
3. Click **Create**, and then click **Close**.

Attaching an image plane

You can use 2D, 3D, and Environment textures with image planes.

Note

Using a 3D or Environment texture with an image plane may cause the texture to swim if the camera is animated. To resolve this, you must link the texture to the camera, so the texture follows the camera in the animation. To link the texture to the camera, parent the place3dTexture node to the animated camera.

Using the Multilister

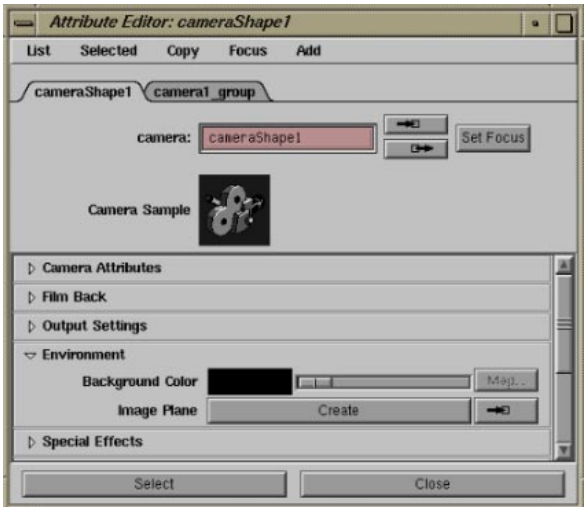
To attach an image plane to a camera:

1. Create a camera for the scene.
2. Select **Window** → **Multilister** to open the Multilister, then go to the Cameras tab.

   You will see the CameraShape or perspShape2 icon for the camera that you just created.

3. Double-click the new camera icon to open the camera's attribute editor.

4 In the **Environment** section, click **Create** next to **Image Plane**.



The image plane's attribute editor appears, and an icon for the image plane appears in the Multilister. The icon is black, indicating that there is no image currently loaded in the image plane. The image plane you create is attached to the camera you created. You must load an image or a texture. For more information on loading an image or a texture, see "Loading an image" on page 110.

Tip

To attach an orthographic image plane for modeling purposes, click the **Fixed** radio button next to **Image Plane** in the **Image Plane Attributes** section of the image plane's attribute editor.

To attach a perspective image plane, click the **Attached To Camera** radio button.

Note

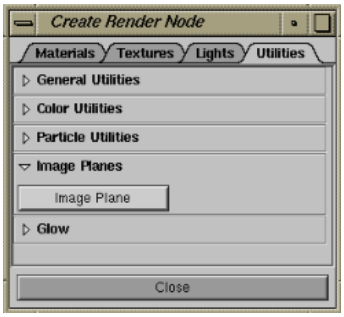
You can change the name of the camera by using the attribute editor or by double-clicking the text under the icon in the Multilister and then entering a new name.

Using drag and drop

To attach an image plane using drag and drop:

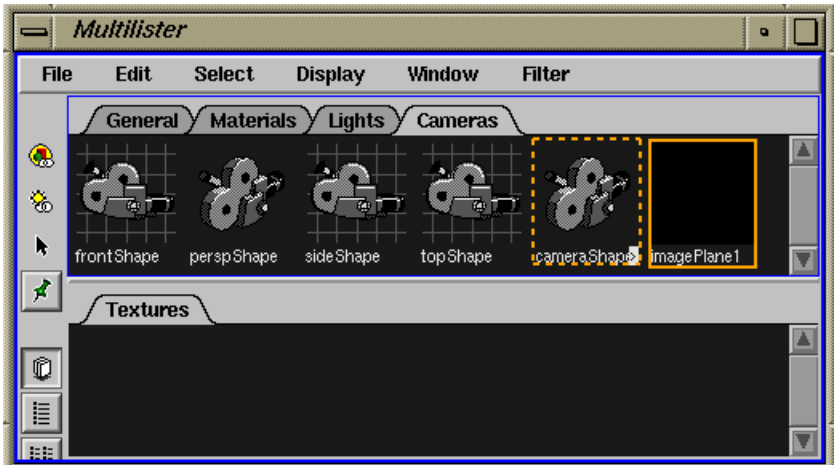
1. Create a camera for the scene.
2. In the Mulitilister, use the right mouse button → **Edit** → **Create**.

   The **Create Render Node** window is displayed.



3. Go to the **Utilities** tab, then click **Image Plane** in the **Image Planes** section.

   An image plane icon is displayed in the **Textures** and **Cameras** tabs in the Multilister.



4. Use the middle mouse button to drag the image plane icon onto a camera icon in the **Cameras** tab.

The image plane is connected to the camera. You must load an image or a texture.

Loading an image

To load an image into an image plane:

1. Create a camera and attach an image plane to it.
2. Double-click the image plane icon in the Multilister to open the image plane's attribute editor.
3. In the **Image Plane Attributes** section, click **Browse** next to **Image Name**, select the image file (or type the path and name of the image file in the field), and click **Open**.

   The image you selected appears in the **Image Plane Sample** in the imagePlane attribute editor and in the image plane icon in the Multilister.

   You can adjust the **Coverage**, **Size**, **Offset**, **Depth**, **Center**, **Width** and **Height** attributes of the image plane in the **Placement** section of the attribute editor.

Tip

To see the image on the image plane in your views, select **Shading** → **Smooth Shade All.**

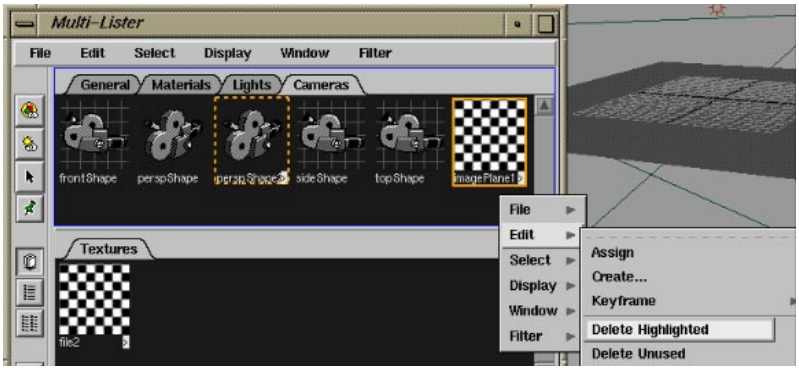
Deleting image planes

To delete an image plane:

1. In the Multilister, go to the Cameras tab, and select the image plane you want to delete.

   The dotted yellow line surrounding the cameral icon indicates that the selected image plane is attached to that camera.

2 Use the right mouse button → **Edit** → **Delete Highlighted**.



The image plane is deleted from the Multilister and from the views.

Note

You can also delete an image plane by using the **Select by component type** button. Select the image plane you want to delete in a view, then press **Delete**. The image plane is deleted from the views and from the Multilister.

Loading a scene in the image plane

To load a scene in the image plane:

1 Create a camera for the scene (see “To create a one-node camera:” on page 105).

2 Attach an image plane to the camera (see “To attach an image plane using drag and drop:” on page 109).

3 In the **Placement** section of the image plane’s attribute editor, change the **Depth** to 20 from 100.

4 In the **Image Plane Attributes** section, click **Browse** next to **Image Name**, or type in the path and file name of the image you want to load.

When you are rotoscoping, you must enter one image file from a series of image files that are part of a scene or animation. The image is displayed in the **Image Plane Sample** in the attribute editor.

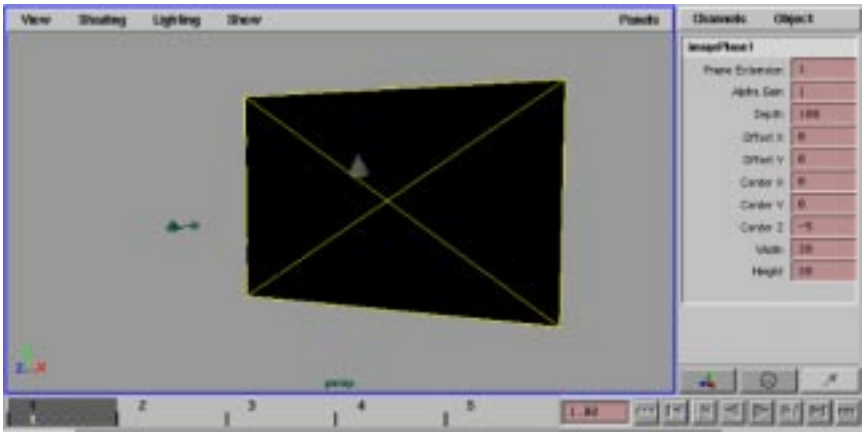
Tip

To see the image on the image plane in your views, select **Shading** → **Smooth Shade All.**

5 Toggle on **Use Frame Extension**.

The **Frame Extension** box is enabled.

6 In the **Timeline**, make sure you start on time 1 (see *Using Maya: Animation*).



7 In the image plane attribute editor, set a key for **time 1** by clicking the right mouse button over the **Frame Extension** label, and selecting **Set key**.

8 In the **Timeline**, go to the last time. For example, if the **Timeline** has 24 seconds, go to time 24.

9 Enter the number of the last image in the series on the **Frame Extension** box.

The image plane in the view updates, displaying the image file you just entered.

10 Set a key.

You can play the animation by clicking the **Play** button in the **Timeline**.

Image plane attributes

Display Selects where you see the image plane from: **looking through camera** or **in all views**.

Display Mode Selects the image plane's display mode: one of: None, Outline, RGB, RGBA, Luminance, Alpha.

Color Gain	The color gain.
Color Offset	The color offset.
Alpha Gain	Scale factor for the alpha channel.
Image Plane	Determines where the image plane is created, either **Attached to Camera** or **Fixed**.
Type	Either **Image File** or **Texture**.
Image Name	If you use an image file, you can browse for the name, or enter the name in the **Image Name** field.
Use Frame Extension	Off by default. When on, you can use a **Frame Extension** number.
Frame Extension	The frame extension number.
Texture	Maps a texture to the image plane if you click **Map**. The texture is not displayed in the views, and its placement is a texture placement, not the placement of the image plane. Use the > button to navigate to the upstream node. Click the **Map** button a second time to break a connection and / or make a new connection.

Placement attributes for attached image planes

An attached image plane moves relative to the camera. This is the default image plane created on perspective cameras.

Size	The width and height of the image plane as measured in the camera's film back (inches). The image plane will be clipped if the size is greater than the camera's film aperture.
Squeeze Correction	Horizontal stretch to apply. Can be used to compensate for lens squeeze ratio and device squeeze ratio when image plane matching.
Offset	The width and height to offset the center of the image plane in the camera's film back.
Depth	The distance the image plane is from the camera's eye point along the view vector.

Placement attributes for fixed image planes

A fixed image plane is independent of the camera, and occupies a fixed position in world space. The image plane automatically orients itself to face the camera when the camera moves, and is well suited for tracing. Fixed image planes are created by default for orthographic cameras.

Center The center position of the image plane in world space.

Width The width of the image plane in world space.

Height The height of the image plane in world space.

Image plane fit

Fill Ensures the image fills the entire coverage rectangle (defined by image plane's size if the image plane is attached, or the width and height if the image plane is fixed). The image aspect ratio is maintained. The image may extend horizontally or vertically past the coverage rectangle.

Best Ensures the image fits inside the entire coverage rectangle. The image aspect ratio is maintained.

Horizontal Ensures the horizontal width of image is inside the coverage rectangle. The image aspect ratio is maintained, and the image may extend vertically past the coverage rectangle.

Vertical Ensures the vertical height of the image is inside the coverage rectangle. The image aspect ratio is maintained, and the image may extend horizontally past the coverage rectangle.

To Size The image will fill the entire coverage rectangle and the image aspect ratio is not maintained (the image will be stretched).

Image plane crop

Allows the user to extract a sub-region from the input image.

Coverage X Specifies the number of horizontal pixels to include in the sub-region.

Coverage Y Specifies the number of vertical pixels to include in the sub-region.

Coverage Origin X Horizontal offset in pixels to the bottom left corner of the sub-region.

Coverage Origin Y Vertical offset in pixels to the bottom left corner of the sub-region.

11 Partial Image Rendering

Partial image rendering lets you render a specific part of an image, for example, if you adjust a parameter and want to see the effect on a particular part of an image, without rendering the whole image again. This can save time during the testing stages of your rendering.

This chapter contains the following sections:

- "Rendering part of an image" on page 117
- "Test settings menu" on page 119

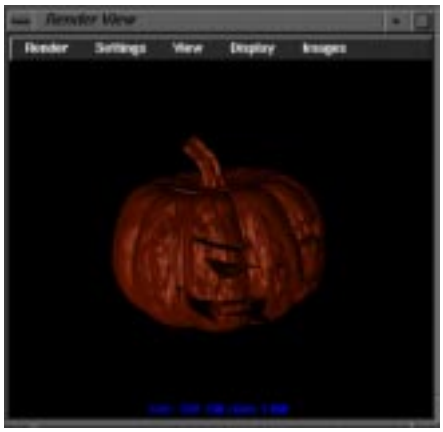
Rendering part of an image

To render part of an image, you must start with a rendered image in the Render View window.

To render part of an image

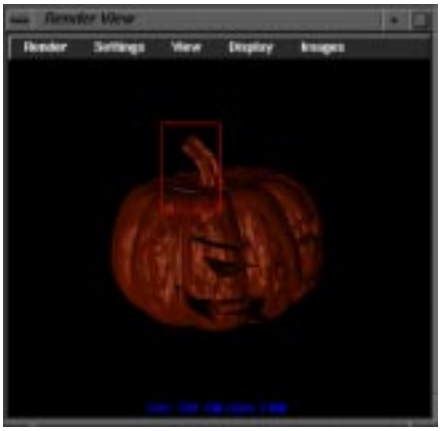
1 Open the Render View window, and render an image (use the right mouse button → Render → persp).

Wait for the image to be completely rendered.



2 Make any changes to the parameters of the object or scene you are working on.

3 Using the left mouse button, drag a marquee around the part of the previous image you want to render.

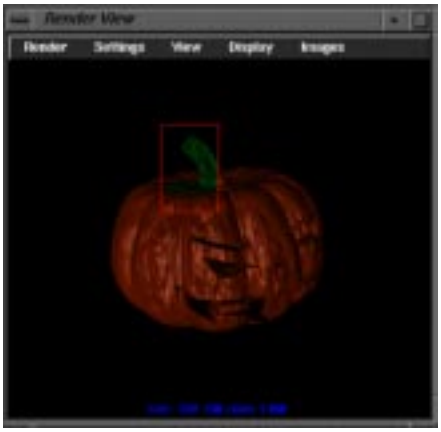


A red marquee is displayed around the part of the image you want to render.

4 Use the right mouse button → **Test settings** → **Test resolution** → **Render Globals (256x256)**.

5 Use the right mouse button → **Render region**.

Only the part within the red marquee is rendered. The rest of the image is still displayed in the Render View window.



Test settings menu

The Test Settings menu contains items to help you customize your test render scenarios.

Test resolution Set the test resolution for the Render View window.

- Camera panel
- Render globals (256x256)
- 50% globals (128x128)
- 25% globals (64x64)
- 10% globals (25x25)

Auto resize Prevents the Render View window from resizing the image each time you render.

Auto render region When this is set, renders the image as soon as you finish dragging a marquee in the Render View window.

Redo last takes region Renders the last region that was rendered.

Show region Displays the red marquee in the Render View window. The marquee disappears when you render at full resolutions, so to see the marquee, you must use **Show region**.

12 Animating Render Node Attributes

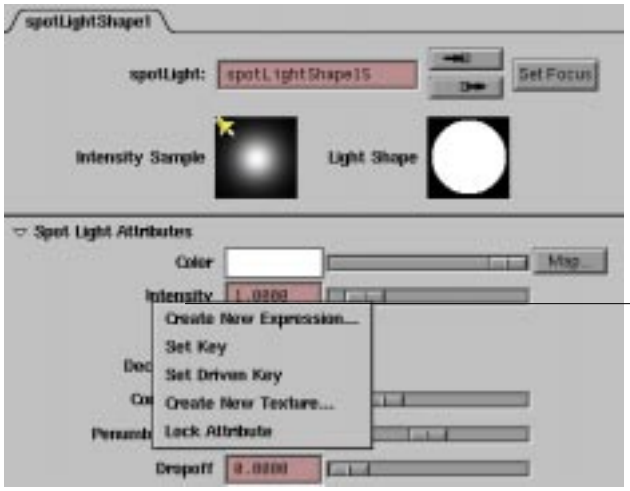
You can animate render nodes and their attributes (for example, a light's intensity or a texture's bump value) in Maya. Animating render node attributes has a simple workflow, and can be done in a few simple steps.

Animating render node attributes

The following example describes how to animate the Intensity of a light. The same procedure works for all render node attributes, whether you're animating a texture, a bump map, or a the Density attribute of an Environment Fog shader.

To animate a light's Intensity attribute:

1 Create a Spotlight and open its attribute editor.



Use the right mouse button → Set Key to set a key for the Spotlight's Intensity attribute.

2 In a modeling view, click the **timeline** to establish a frame (see *Using Maya: Animation*).

3. In the Spot Light Attributes section of the Spotlight's attribute editor, position the cursor over the **Intensity** label, then use the right mouse button → **Set Key**.

   A key tick is created in the **timeline**, indicating that a key has been set for the **Intensity**.

4. Click the **timeline** again in another frame.

5. Set another key for the Intensity attribute by repeating Step 3.

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